Series 3730
Type 3730-2 Electropneumatic Positioner

Fig. 1 · Type 3730-2

Mounting and Operating Instructions

EB 8384-2 EN (1300-1611)

Firmware version 1.56

Edition February 2015

CE Ex certified

EB + CD

Definitions of the signal words used in these instructions

⚠ ***DANGER!***
indicates a hazardous situation which, if not avoided, will result in death or serious injury.

WARNING!
indicates a hazardous situation which, if not avoided, could result in death or serious injury.

NOTICE
indicates a property damage message.

Note: *Supplementary explanations, information and tips*

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Note: *The functions of* ***EXPERTplus*** *valve diagnostics are described in the Mounting and Operating Instructions* ***EB 8389 EN***

Modifications of positioner firmware in comparison to previous versions	
Previous	**New**
1.01	**1.10**
	The serial interface and serial interface adapter allow the positioner to be operated and configured using TROVIS-VIEW software
	The following additional status messages were implemented: Code **76** - No emergency mode Code **77** - Program loading error Displays number of zero calibrations performed since the last initialization.
	For initialization of "AIR TO CLOSE" actuators, the direction of action (Code **7**) is automatically set to increasing/decreasing.
	Code **3**, the activation period of the enabled configuration function was extended to 120 s.
1.10	**1.20**
	Electronics changed, no new functions added.
1.20	**1.30**
	New EXPERTplus diagnostics functions (Code **48**) added Positioner in EXPERTplus version with extended diagnostics features.
	A running initialization can be canceled by pressing the rotary pushbutton.
	The position transmitter (Code **37**) and solenoid valve (Code **45**) options are automatically recognized.
1.30	**1.40**
	All EXPERTplus functions can be used in this firmware version and higher.
	The fault alarm contact is triggered by the condensed state of the positioner. It is always active when condensed state = "Maintenance alarm". If Code **32** is set to *Yes*: Also active with "Function check" condensed state If Code **33** is set to *Yes*: Also active with "Maintenance required/Maintenance demanded" condensed state
	The "Function check" condensed state is additionally set for Test A1, A2, fault alarm output and position transmitter.
	The min./max. values of the temperature monitoring can be reset.
1.40	**1.41**
	Internal modifications
1.41	**1.42**
	Internal modifications

Modifications of positioner firmware in comparison to previous versions	
Previous	**New**
1.42	**1.51**
	All EXPERTplus diagnostic functions are available in the positioner without having to activate them first (refer to EB 8389 EN on EXPERTplus valve diagnostics)
	Optional **binary input** with following actions: – Transfer switching state – Set local operation write protection – Switch between AUTO/MAN – Various diagnositic functions (refer to EB 8389 EN on EXPERTplus valve diagnostics)
	The pressure limit (Code **16**) is no longer automatically set during initialization.
1.51	**1.54**
	Internal modifications
1.54	**1.55**
	Code 4: The setting for **300 mm** has been added to the pin position
1.55	**1.56**
	Internal modifications

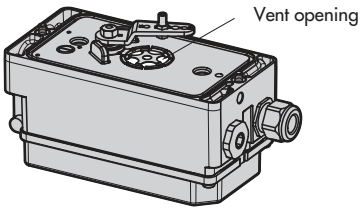
1 Important safety instructions

For your own safety, follow these instructions concerning the mounting, start-up and operation of the positioner:

- The positioner is to be mounted, started up or operated only by trained and experienced personnel familiar with the product.
  According to these Mounting and Operating Instructions, trained personnel refers to individuals who are able to judge the work they are assigned to and recognize possible dangers due to their specialized training, their knowledge and experience as well as their knowledge of the applicable standards.
- Explosion-protected versions of this positioner are to be operated only by personnel who have undergone special training or instructions or who are authorized to work on explosion-protected devices in hazardous areas. Refer to section 11.
- Any hazards that could be caused by the process medium, the operating pressure, the signal pressure or by moving parts of the control valve are to be prevented by means of the appropriate measures.
- If inadmissible motions or forces are produced in the pneumatic actuator as a result of the supply pressure, the supply pressure must be restricted by means of a suitable supply pressure reducing station.

To avoid damage to any equipment, the following also applies:

- Do not operate the positioner with the back of the positioner/vent opening facing upwards.
  The vent opening must not be sealed when the positioner is installed on site.



- Proper shipping and appropriate storage are assumed.
- Do not ground electric welding equipment near to the positioner.

Note: *The device with a CE marking fulfills the requirements of the Directives 94/9/EC and 2004/108/EC.*
The Declaration of Conformity is available on request.

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2 Article code

Article code		Type 3730-2	x	x	x	x	x	x	x	x	0	x	0	0	x	0	x	x
With LC display, autotune																		
Explosion protection																		
Without		0																
ATEX: II 2G Ex ia IIC T6 Gb; II 2D Ex tb IIIC T80°C Db IP66		1																
CSA: Ex ia IIC T6, Class I Zone 0; Class I, Groups A, B, C, D; Class II, Groups E, F, G; Class III; Type 4 Enclosure Class I, Zone 2; Class I, Div. 2, Groups A, B, C, D; Class II, Div. 2, Groups E, F, G; Class III; Type 4 Enclosure		3																
FM: Class I, Zone 0 AEx ia IIC; Class I,II,III, Div.1, Groups A, B, C, D, E, F, G; Class I, Div.2, Groups A, B, C, D; Class II, Div.2, Groups F, G																		
JIS: Ex ia IIC T6		7																
ATEX: II 3G Ex nA II T6; II 3D Ex ic IIC T6; II 3D Ex tc IIIC T80°C IP66		8																
Options (additional equipment)																		
Inductive limit switch	Without		0															
	With SJ2-SN (NC contact)		1				0											
	With SJ2-S1N (NO contact)		2															
Solenoid valve	Without			0														
	24 V DC			4														
Analog position transmitter	Without				0													
	With				1													
External position sensor	Without					0												
	With		0			1												
	Connection prepared		0			2												
Leakage sensor	Without						0											
	With						1											
Binary input	Without							0										
	With				0			2										
Diagnostics																		
EXPERTplus									4									
Housing material																		
Aluminum											0							
Stainless steel 1.4581						0					1							
Special applications																		
Without															0			
Compatible with paint															1			
Exhaust air with ¼ NPT connection, back of housing sealed															2			
Attachment according to VDI/VDE 3847 including interface															6			
Attachment according to VDI/VDE 3847 prepared for interface															7			
Special versions																		
Without																0	0	
IECEx: Ex ia IIC T4/T5/T6; IP54 and IP65 T80°C		1														1	2	
GOST (EAC): 1Ex ia IIC T6/T5/T4 Gb X; Ex tb IIIC T 80°C Db X		1														1	4	
GOST (EAC): 2Ex nA IIC T6/T5/T4 Gc X; 2Ex ic IIC T6/T5/T4 Gc X; Ex tc IIIC T 80°C Dc X		8														2	0	

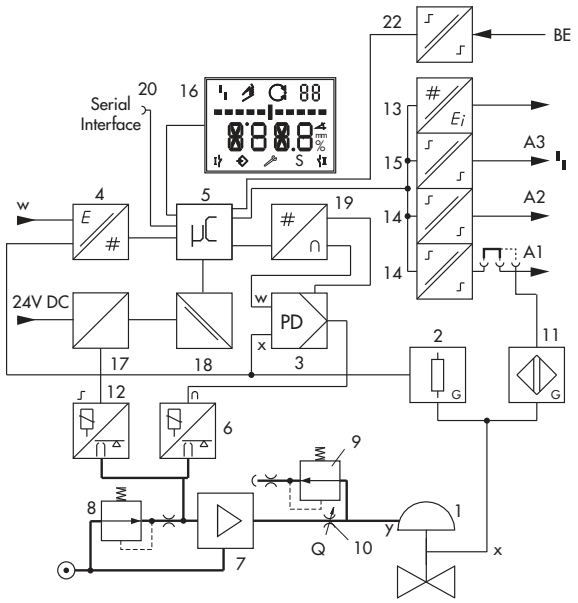
3 Design and principle of operation

The electropneumatic positioner is attached to pneumatic control valves. It is used to assign the valve stem position (controlled variable x) to the control signal (reference variable w). The input signal received from a control system is compared to the travel or rotational angle of the control valve, and a pneumatic signal pressure (output variable y) is produced.

The positioner basically consists of an electrical travel sensor system (2), an analog i/p converter (6) with downstream air capacity booster (7) and the electronic unit with a microcontroller (5).

The standard positioner is fitted with three binary contacts: A fault alarm output indicates a fault to a control station and two configurable software limit switches are used to indicate the end positions of the valve.

The position of the valve is transmitted as linear travel motion or angle of rotation via pick-up lever and travel sensor (2) to an analog PD controller (3). Simultaneously, an A/D converter (4) transmits the position of the valve to the microcontroller (5). The PD controller compares this actual position to



1 Control valve
2 Travel sensor
3 PD controller
4 A/D converter
5 Microcontroller
6 i/p converter
7 Air capacity booster
8 Pressure regulator
9 Flow regulator
10 Volume restriction
11* Inductive limit switch
12* Solenoid valve
13* Analog position transmitter
14 Software limit switches Alarm 1/2
15 Fault alarm output Alarm 3
16 Display
17* Solenoid valve control
18* Galvanic isolation
19 D/A converter
20 Communication interface
22 Binary input BE*
* Optional

Fig. 2 · Functional diagram

the 4 to 20 mA DC control signal (reference variable) after it has been converted by the A/D converter (4). In case of a system deviation, the actuator is either vented or filled with more air. The supply air is supplied to the air capacity booster (7) and the pressure regulator (8). An intermediate flow regulator (9) with fixed settings is used to purge the positioner and also guarantees trouble-free operation of the air capacity booster. The output signal pressure supplied by the booster can be limited over the software. The volume restriction Q (10) is used to optimize the positioner by adapting it to the actuator size.

The extended EXPERTplus diagnostics are integrated into the positioner. It provides information on the positioner and generates diagnostic and status alarms, which allow faults to be pinpointed quickly.

The positioner is suitable for the following types of attachment using the corresponding accessories:

- Direct attachment to SAMSON Type 3277 Actuator: Section 4.1
- Attachment to actuators acc. to IEC 60534-6 (NAMUR): Section 4.2
- Attachment to Type 3510 Micro-flow Valve: Section 4.4
- Attachment to rotary actuators acc. to VDI/VDE 3845: Section 4.5

3.1 Additional equipment

Solenoid valve

If the operating voltage for the solenoid valve (12) fails, the supply pressure for the booster is vented to the atmosphere. Consequently, the actuator is vented and the valve moves to the fail-safe position.

NOTICE

In manual mode (MAN), the manual set point is also reset to 0 %. A different manual set point must be entered again (Code 1).

Position transmitter

The position transmitter (13) is a two-wire transmitter and issues the travel sensor signal as a 4 to 20 mA signal processed by the microcontroller. Since this signal is issued independent of the positioner's input signal (min. current 3.8 mA), the actual travel/angle of rotation is controlled in real-time. Additionally, the position transmitter provides the possibility of signaling a positioner fault over a signal current of < 2.4 mA or > 21.6 mA.

Inductive limit switch

The rotary shaft of the positioner carries an adjustable tag which actuates the installed proximity switch. The optional inductive limit switch (11) is connected to A1, while the remaining software limit switch is connected to A2.

External position sensor

In this version, only the sensor is mounted to the control valve. The positioner is located separately from the valve.
The connection of x and y signals to the valve is established by cable and piping for air (only without inductive limit switch).

Leakage sensor

By upgrading the positioner with a leakage sensor, it is possible to detect seat leakage when the valve is in the closed position.

Binary input

The positioner has an optional binary input. The following actions can be performed over the binary input:

- **Transfer switching state** [default]
  The switching state of the binary input is logged.
- **Set local operation write protection**
  Settings cannot be changed at the positioner while the binary input is active. The configuration enabled function in Code **3** is not active.
- **Switch between AUTO/MAN**
  The positioner changes from automatic mode ↻ (AUTO) mode into manual mode ✎ (MAN) and vice versa.
  No action is started if the positioner is in the fail-safe position (SAFE).
- Various diagnostic functions (refer to EB 8389 EN on EXPERTplus valve diagnostics)

Note: *The optional binary input can only be configured using the TROVIS-VIEW software (refer to EB 8389 EN on EXPERTplus valve diagnostics).*
The default switching state is with an open switch.

3.2 Configuration using TROVIS-VIEW software

Refer to Table 6 on page 50 for order numbers.

The positioner can be configured using the TROVIS-VIEW software.
The positioner is equipped for this purpose with an additional digital **SERIAL INTERFACE** to allow a computer to be connected over an adapter cable from the RS-232 or USB port of the computer to the positioner.
The TROVIS-VIEW software enables the user to easily set parameters in the positioner and view process parameters online.

Note: *The TROVIS-VIEW software is a common operator interface for various smart SAMSON devices. The software together with a device-specific module allow the configuration and parameterization of the device.*
The device-specific module for Type 3730-2 can be downloaded free of charge from the SAMSON website (Services > Software > TROVIS-VIEW).
Additional information on TROVIS-VIEW (e.g. system requirements) can found on the SAMSON website and in the Data Sheet T 6661 EN.

3.3 Technical data

Type 3730-2 Positioner **(the listed technical data of explosion-protected devices may be restricted by the limits specified in the test certificate)**	
Travel, adjustable	Direct attachment to Type 3277 Actuator: 3.6 to 30 mm Attachment acc. to IEC 60534-6-1: 3.6 to 300 mm Attachment acc. to VDI/VDE 3847: 3.6 to 300 mm Rotary actuators: 24° to 100°
Travel range	Adjustable within the initialized travel/angle of rotation; travel can be restricted to $\frac{1}{5}$ at the maximum
Reference variable w	Signal range 4 to 20 mA, 2-wire unit, reverse polarity protection, min. span 4 mA, static destruction limit 100 mA
Minimum current	3.6 mA for display · 3.8 mA for operation
Load impedance	Version without explosion protection: ≤ 6 V (corresponding to 300 Ω at 20 mA) Explosion-protected version: ≤ 7 V (corresponding to 350 Ω at 20 mA)
Supply air	Supply pressure from 1.4 to 7 bar (20 to 105 psi), Air quality acc. to ISO 8573-1 (2001): Max. particle size and density: Class 4 Oil content: Class 3, pressure dew point: Class 3 or at least 10 K beneath the lowest ambient temperature to be expected
Signal pressure (output)	0 bar up to the capacity of supply pressure, limitable to 1.4/2.4/3.7 ±0.2 bar via software
Characteristic	Linear/equal percentage/reverse equal percentage user-definable (over operating software) butterfly valve, rotary plug valve, segmented ball valve: linear/equal percentage Deviation from terminal-based conformity ≤ 1 %
Hysteresis	≤ 0.3 %
Sensitivity	≤ 0.1 %
Transit time	Venting and filling with air adjustable separately up to 240 seconds by software
Direction of action	Reversible
Air consumption, steady state	Independent from supply pressure approx. 110 l_n/h
Air output capacity Actuator filled with air Actuator vented	At Δp = 6 bar: 8.5 m_n^3/h, at Δp = 1.4 bar: 3.0 m_n^3/h $K_{Vmax\ (20\ °C)}$ = 0.09 at Δp = 6 bar: 14.0 m_n^3/h, at Δp = 1.4 bar: 4.5 m_n^3/h $K_{Vmax\ (20\ °C)}$ = 0.15
Permissible ambient temperature	–20 to +80 °C in all versions –45 to +80 °C with metal cable gland –25 to +80 °C with inductive limit switches (SJ2-S1N) and metal cable gland The listed technical data of explosion-protected devices may be restricted by the limits specified in the test certificate
Influences	Temperature: ≤ 0.15 %/10 K Supply air: None Vibration: ≤ 0.25 % up to 2000 Hz and 4 g acc. to IEC 770

Type 3730-2 Positioner **(the listed technical data of explosion-protected devices may be restricted by the limits specified in the test certificate)**		
Electrical connections	One M20 x 1.5 cable gland for 6 to 12 mm clamping range · Additional second M20 x 1.5 threaded hole · Screw terminals for 0.2 to 2.5 mm² wire cross-section	
Degree of protection	IP 66/NEMA 4X	
Use in safety-instrumented systems (SIL)	Observing the requirements of IEC 61508, the systematic capability of the control valve for emergency venting as a component in safety-instrumented systems is given.	
Emergency venting at 0 mA set point and on using the optional solenoid valve	Use is possible on observing the requirements of IEC 61511 and the required hardware fault tolerance in safety-instrumented systems up to SIL 2 (single device/HFT = 0) and SIL 3 (redundant configuration/HFT = 1).	
Explosion protection	See table on summary of explosion protection certificates for Type 3730-2	
Communication (local)	SAMSON SSP interface and serial interface adapter	
Software requirements	TROVIS-VIEW with database module 3730-2	
Binary contacts		
For connection to	- Binary input of a PLC acc. to IEC 61131-2, P_{max} = 400 mW - NAMUR switching amplifiers acc. to EN 60947-5-6	NAMUR switching amplifiers acc. to EN 60947-5-6
2 software limit switches, reverse polarity protection, floating, configurable switching characteristics, default settings as per table		
Signal status: No response: Response:	**Without explosion protection:** Non-conducting Conductive (R = 348 Ω)	**Exp.-protected version:** ≤ 1.0 mA ≥ 2.2 mA
One fault alarm contact, floating		
Signal status: No response/No alarm Response/Fault alarm	**Without explosion protection:** Conductive (R = 348 Ω) Non-conducting	**Exp.-protected version:** ≥ 2.2 mA ≤ 1.0 mA

Type 3730-2 Positioner **(the listed technical data of explosion-protected devices may be restricted by the limits specified in the test certificate)**	
Materials	
Housing	Die-cast aluminum EN AC-AlSi12(Fe) (EN AC-44300) acc. to DIN EN 1706, chromated and powder paint coated · Special version: Stainless steel 1.4581
External parts	Stainless steel 1.4571 and 1.4301
Cable gland	M20x1.5, black polyamide
Weight	Approx. 1.0 kg
Compliance	CE EAC
Options for Type 3730-2 Positioner	
Solenoid valve · Approval acc. to IEC 61508/SIL	
Input	24 V DC reverse polarity protection, static destruction limit 40 V; Current consumption $I = \frac{U - 5.7\ V}{3840\ \Omega}$ (corresponding to 4.8 mA at 24 V/114 mW)
Signal "0" no pick-up	≤ 12 V (emergency venting at 0 V)
Signal "1" safe pick-up	> 19 V
Service life	> 5 x 10^6 switching cycles
K_V coefficient	0.15
Leakage sensor · Suitable for operation in hazardous areas	
Temperature range	–40 to +130 °C
Tightening torque	20 ±5 Nm
Analog position transmitter	Temperature range
Supply voltage	Tightening torque
Output signal	4 to 20 mA
Direction of action	Reversible
Operating range	–10 to +114 %
Characteristic	Linear
Hysteresis and HF influence	Same as positioner
Other influences	Same as positioner
Fault indication	Can be issued with current signal 2.4 ±0.1 mA or 21.6 ±0.1 mA
Inductive limit switch	For connection to switching amplifier acc. to EN 60947-5-6. Can be used in combination with a software limit switch.
SJ2-SN proximity switch	NAMUR NC contact
SJ2-S1N proximity switch	NAMUR NO contact

External position sensor		
Travel		Same as positioner
Cable		10 m with M12x1 connector, designed for continuous flexing, flame retardant acc. to VDE 0472, resistant to oils, lubricants, coolants as well as other corrosive media
Permissible ambient temperature		–60 to +105 °C · Limits specified in the EC Type Examination Certificate additionally apply for explosion-protected devices.
Vibration immunity		Up to 10 g in the range between 10 and 2000 Hz
Degree of protection		IP 67
Binary input · Galvanically isolated · Switching behavior configured over software (e.g. TROVIS-VIEW, DTM)		
Active switching behavior (default setting)		
Connection		For external switch (floating contact) or relay contacts
Electrical data		Open-circuit voltage when contact is open: max. 10 V, pulsed DC current, peak value 100 mA and RMS value of 0.01 mA when contact is closed
Contact	Closed, R < 20 Ω	"On" switching state (default setting)
	Open, R > 400 Ω	"Off" switching state (default setting)
Passive switching behavior		
Connection		For externally applied DC voltage, reverse polarity protection
Electrical data		3 to 30 V, destruction limit 40 V, current draw 3.7 mA at 24 V
Voltage	> 6 V	"On" switching state (default setting)
	< 1 V	"Off" switching state (default setting)

Summary of explosion protection certificates for Type 3730-2

Type 3730	Certification			Type of protection/comments
-2	IECEx	Number Date	IECEx PTB 05.0007 2005-02-21	Ex ia IIC T4/T5/T6 IP54 and IP65 T80°C
-2	**STCC**	Number Valid until	972 2017-10-01	0Ex ia IIC T6X 2Ex s II T6 X
-21	EC-type examination certificate	Number Date	PTB 00 ATEX 2158 2013-08-19	II 2G Ex ia IIC T6 Gb II 2D Ex tb IIIC T80°C Db IP66
-21	**CCoE**	Number Date Valid until	A/P/HQ/MH/104/1339 2012-01-27 2017-01-27	Ex ia IIC T6
-21	EAC Ex	Number Date Valid until	RU C-DE.08.B000697 2014-12-15 2019-12-14	1Ex ia IIC T6/T5/T4 Gb X Ex tb IIIC T 80°C Db X
-21	**INMETRO**	On request		
-21	**KCS**	Number Date Valid until	11-KB4BO-0214 2011-10-24 2016-10-24	Ex ia IIC T6/T5/T4
-21	Ex NEPSI	Number Datum Valid until	GYJ14.1286 2014-11-05 2019-11-04	Ex ia IIC T4...T6 Gb
-23	CSA®	Number Date	1330129 2009-02-19	Ex ia IIC T6, Class I Zone 0; Class I, Groups A, B, C, D; Class II, Groups E, F, G; Class III; Type 4 Enclosure Class I, Zone 2; Class I, Div. 2, Groups A, B, C, D; Class II, Div. 2, Groups E, F, G; Class III; Type 4 Enclosure
-23	FM APPROVED	Number Date	3012394 2011-08-11	Class I, Zone 0 AEx ia IIC; Class I,II,III, Div.1, Groups A, B, C, D, E, F, G; Class I, Div.2, Groups A, B, C, D; Class II, Div.2, Groups F, G
-27	**JIS**	Number Valid until	TC18159 2016-11-25	Ex ia IIC T6
-28	EC-type examination certificate	Number Valid until	PTB 03 ATEX 2116 X 2008-11-06	II 3G Ex nA II T6 II 3D Ex ic IIC T6 II 3D Ex tc IIIC T80°C IP66

Type 3730	Certification			Type of protection/comments
-28	EAC Ex	Number Date Valid until	RU-C-DE.08.B.00697 2014-12-15 2019-12-14	2Ex nA IIC T6/T5/T4 Gc X 2Ex ic IIC T6/T5/T4 Gc X Ex tc IIIC T 80°C Dc X
-28	**INMETRO**	On request		
-28	Ex NEPSI	Number Date Valid until	GYJ14.1287X 2014-11-05 2019-11-04	Ex ic IIC T4...T6 Gc Ex nA IIC T4...T6 Gc

4 Attachment to the control valve – Mounting parts and accessories

WARNING!
Attach the positioner, keeping the following sequence:
1. Mount the positioner on the control valve
2. Connect the supply air
3. Connect the electrical power
4. Perform the start-up settings

The positioner is suitable for the following types of attachment:

- Direct attachment to SAMSON Type 3277 Actuator
- Attachment to actuators according to IEC 60534-6 (NAMUR)
- Attachment to Type 3510 Micro-flow Valve
- Attachment to rotary actuators

NOTICE
Attach the positioner to the control valve, observing the following instructions to avoid damaging the positioner.
– *Use only the mounting parts/accessories listed in the Tables 1 to 7 (pages 47 to 51) to mount the positioner. Observe the type of attachment!*
– *Observe the assignment between lever and pin position (see travel tables on page 19).*

Lever and pin position

The positioner is adapted to the actuator and to the rated travel by the lever on the back of the positioner and the pin inserted into the lever.

The travel tables on page 19 show the maximum adjustment range at the positioner. The travel that can be implemented at the valve is additionally restricted by the selected fail-safe position and the required compression of the actuator springs.

The positioner is standard equipped with the lever **M** (pin position **35**).

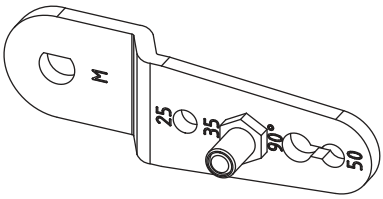


Fig. 3 · Lever M with pin position 35

Note: *If the standard mounted lever M (pin position 35) is replaced, the newly mounted lever must be moved once all the way as far as it will go in both directions to adapt it to the internal measuring lever.*

Travel tables

__Note:__ The lever __M__ is included in the scope of delivery.
Levers __S__, __L__, __XL__ for attachment according to IEC 60534-6 (NAMUR) are available as accessories (see Table 3 on page 49).

Direct attachment to Type 3277-5 and Type 3277 Actuators

Actuator size [cm²]	Rated travel [mm]	Adjustment range at positioner [1] Min.	Travel	Max.	Required lever	Assigned pin position
120	7.5	5.0	to	25.0	M	25
120/175/240/350	15	7.0	to	35.0	M	35
355/700/750	30	10.0	to	50.0	M	50

Attachment according to IEC 60534-6 (NAMUR)

SAMSON valves/Type 3271 Actuator Actuator size [cm²]	Rated travel [mm]	Adjustment range at positioner [1] Other valves/actuators min.	Travel	max.	Required lever	Assigned pin position
60 and 120 with Type 3510 Valve	7.5	3.6	to	18.0	S	17
120	7.5	5.0	to	25.0	M	25
120/175/240/350	15	7.0	to	35.0	M	35
700/750	7.5					
355/700/750	15 and 30	10.0	to	50.0	M	50
1000/1400/2800	30	14.0	to	70.0	L	70
1000/1400/2800	60	20.0	to	100.0	L	100
1400/2800	120	40.0	to	200.0	XL	200

Attachment to rotary actuators according to VDI/VDE 3845

Rotary actuators Min.	Opening angle	Max.	Required lever	Assigned pin position
24	to	100°	M	90°

[1] The min./max. adjustment range is based on the ***NOM (nominal range)*** initialization mode

4.1 Direct attachment

4.1.1 Type 3277-5 Actuator

Refer to Table 1 on page 47 for the required mounting parts as well as the accessories. Note the travel table on page 19.

Actuator with 120 cm²

Depending on the type of positioner attachment, the signal pressure is routed either left or right of the yoke through a bore to the actuator diaphragm. Depending on the fail-safe action of the actuator "Actuator stem extends" or "Actuator stem retracts" (valve closes or opens if the supply air fails), the switchover plate (9) must first be attached to the actuator yoke. Align the switchover plate with the corresponding symbol for left or right attachment according to the marking (view looking onto the switchover plate).

1. Mount connecting plate (6) or pressure gauge bracket (7) with pressure gauges onto the positioner, making sure both seal rings (6.1) are seated properly.
2. Remove screw plug (4) on the back of the positioner and close the signal pressure output "Output 38" on the connecting plate (6) or on the pressure gauge bracket (7) with the stopper (5) included in the accessories.
3. Place follower clamp (3) on the actuator stem, align and screw tight so that the mounting screw is located in the groove of the actuator stem.
4. Mount cover plate (10) with narrow side of the cut-out opening (Fig. 4, left) pointing towards the signal pressure connection. Make sure that the bonded gasket (14) points towards the actuator yoke.
5. **15 mm travel:** Keep the follower pin (2) at lever **M** (1) on the back of the positioner in the pin position **35** (delivered state).
   7.5 mm travel: Remove the follower pin (2) from the pin position **35**, reposition it in the bore for pin position **25** and screw tight.
6. Insert formed seal (15) into the groove of the positioner housing and the seal ring (10.1) on the back of the housing.
7. Place positioner on the cover plate (10) in such a manner that the follower pin (2) rests on the top of the follower clamp (3). Adjust the lever (1) correspondingly and open the positioner cover to hold the positioner shaft in position at the cap or the switch (Fig. 23).
   The lever (1) must rest on the follower clamp with spring force.
   Mount the positioner on the cover plate (10) using the two fixing screws.

Note for all types of attachment except for direct attachment to Type 3277-5: *The signal pressure output at the back must be sealed using the screw plug (4, order no. 0180-1254) and the associated O-ring (order no. 0520-0412).*

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8. Mount cover (11) on the other side. Make sure that the vent plug points downwards when the control valve is installed to allow any condensed water that collects to drain off.

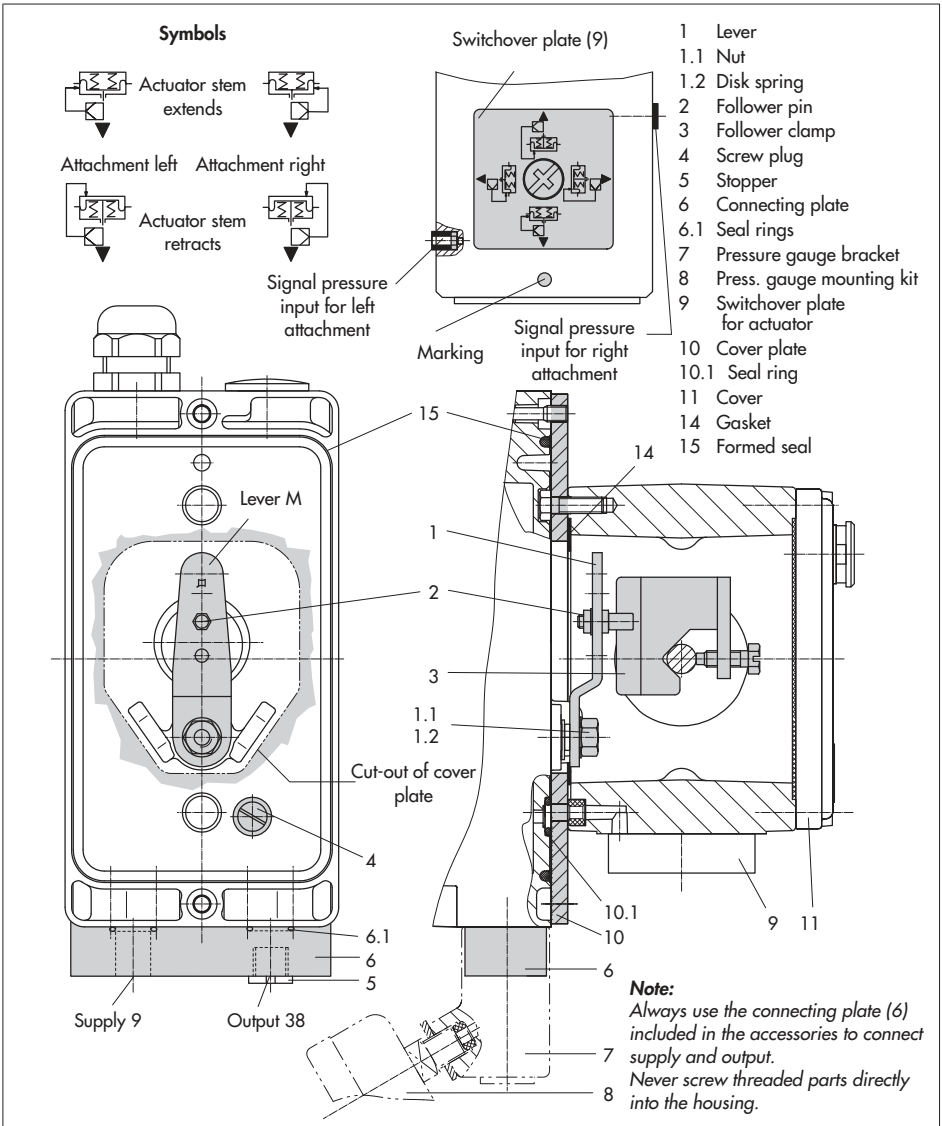


Fig. 4 · Direct attachment - Signal pressure connection for Type 3277-5 Actuator with 120 cm²

4.1.2 Type 3277 Actuator

Refer to Table 2 on page 48 or the required mounting parts as well as the accessories. Note the travel table on page 19.

Actuators with 175 to 750 cm²

Mount the positioner on the yoke as shown in Fig 5). The signal pressure is routed to the actuator over the connection block (12), for actuators with fail-safe action "Actuator stem extends" internally through a bore in the valve yoke and for "Actuator stem retracts" through external piping.

1. Place follower clamp (3) on the actuator stem, align and screw tight so that the mounting screw is located in the groove of the actuator stem.
2. Mount cover plate (10) with narrow side of the cut-out opening (Fig. 5, on the left) pointing towards the signal pressure connection. Make sure that the bonded gasket (14) points towards the actuator yoke.
3. For actuators with 355, 700 and 750 cm², remove the follower pin (2) at lever **M** (1) on the back of the positioner from pin position **35**, reposition it in the bore for pin position **50** and screw tight. For actuators 175, 240 and 350 cm² with 15 mm travel, the follower pin (2) remains in pin position **35**.
4. Insert formed seal (15) in the groove of the positioner casing.
5. Place positioner on the cover plate in such a manner that the follower pin (2) rests on the top of the follower clamp (3). Adjust the lever (1) correspondingly and open the positioner cover to hold the positioner shaft in position at the cap or the switch (Fig. 24). The lever (1) must rest on the follower clamp with spring force. Mount the positioner on the cover plate (10) using the two fixing screws.
6. Make sure that the tip of the gasket (16) projecting from the side of the connection block (12) is positioned above the actuator symbol that corresponds with the actuator with fail-safe action "Actuator stem extends" or "Actuator stem retracts." If necessary, remove the three fixing screws and the cover. Then reposition the gasket (16) turned by 180°. The previous version of the connection block (Fig. 5, bottom) requires the switch plate (13) to be turned such that the corresponding actuator symbol points to the marking.
7. Place the connection block (12) with the associated seal rings against the positioner and the actuator yoke. Screw it tight using the fixing screw (12.1). For actuators with fail-safe action "Actuator stem retracts", additionally remove the stopper (12.2) and fit on the external signal pressure piping.
8. Mount cover (11) on the other side. Make sure that the vent plug points downwards when the control valve is installed to allow any condensed water that collects to drain off.

1	Lever	12	Connection block
1.1	Nut	12.1	Screw
1.2	Disk spring	12.2	Stopper or connection for external piping
2	Follower pin	13	Switch plate
3	Follower clamp	14	Gasket
10	Cover plate	15	Formed seal
11	Cover	16	Gasket
11.1	Vent plug		

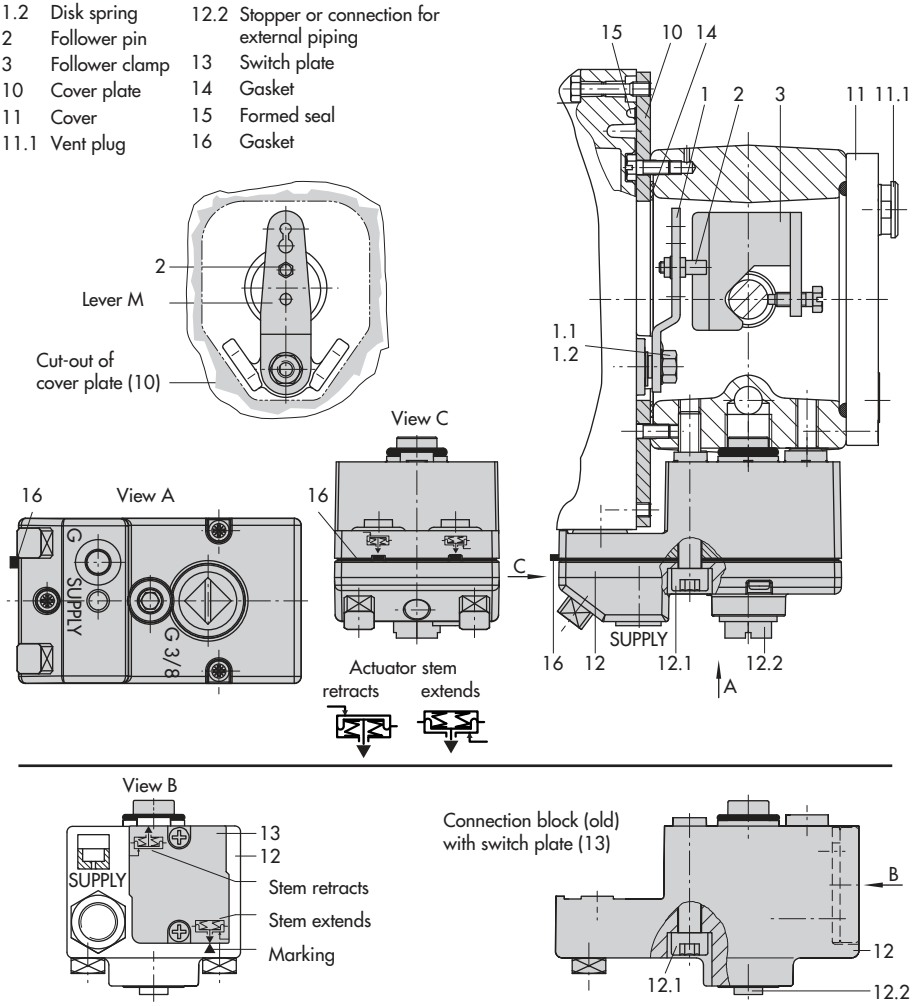


Fig. 5 · Direct attachment – Signal pressure connection for Type 3277 Actuator with 175 to 750 cm²

4.2 Attachment according to IEC 60534-6 (NAMUR)

Refer to Table 3 on page 49 for the required mounting parts as well as the accessories. Note the travel table on page 19.

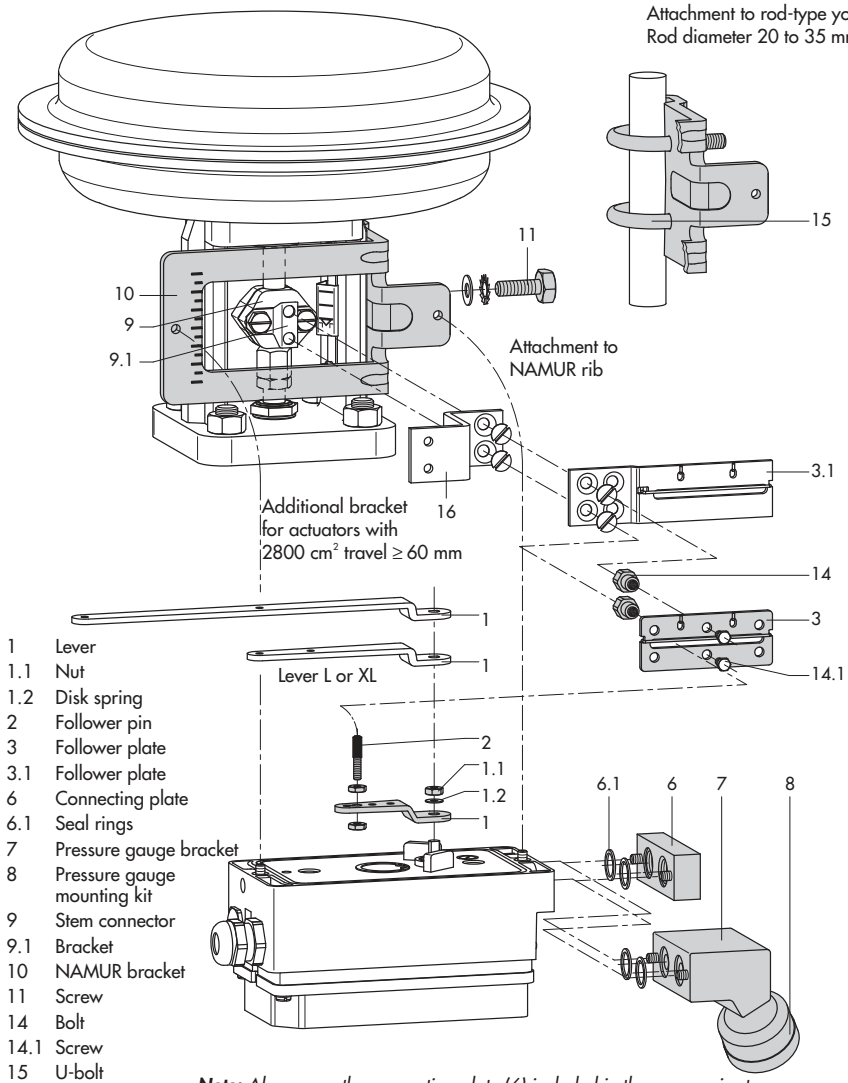
The positioner is attached to the control valve with a NAMUR bracket (10).

1. Screw the two bolts (14) to the bracket (9.1) of the stem connector (9), place the follower plate (3) on top and use the screws (14.1) to tighten.
   Actuator size 2800 cm² and 1400 cm² (120 mm travel):
   – For a travel of 60 mm or smaller, screw the longer follower plate (3.1) directly to the stem connector (9).
   – For a travel exceeding 60 mm, mount the bracket (16) first and then the follower plate (3) to the bracket together with the bolts (14) and screws (14.1).
2. Mount NAMUR bracket (10) to the control valve as follows:
   – For attachment to the NAMUR rib, use an M8 screw (11), washer, and toothed lock washer directly in the yoke bore.
   – For attachment to valves with rod-type yokes, use two U-bolts (15) around the yoke.
   Align the NAMUR bracket (10) in such a way that the slot of the follower plate (3) is centrally aligned with the NAMUR bracket at mid valve travel.
3. Mount connecting plate (6) or pressure gauge bracket (7) with pressure gauges (8) on the positioner, making sure both seal rings (6.1) are seated properly.
4. Select required lever size (1) **M**, **L** or **XL** and pin position according to the actuator size and valve travels listed in the table on page 19.
   Should you require a pin position other than position **35** with the standard installed lever **M**, or require a lever size **L** or **XL**, proceed as follows:
5. Screw the follower pin (2) in the assigned lever bore (pin position) as listed in the table. Only use the longer follower pin (2) included in the mounting kit.
6. Place lever (1) on the positioner shaft and screw tight using the disk spring (1.2) and nut (1.1).

Note: *If you have mounted a new lever (1), you must move it once all the way as far as it will go in both directions.*

---

7. Place positioner on the NAMUR bracket in such a manner that the follower pin (2) rests in the slot of the follower plate (3, 3.1). Adjust the lever (1) correspondingly.
   Screw the positioner to the NAMUR bracket using both its fixing screws.



Note: *Always use the connecting plate (6) included in the accessories to connect supply and output. Never screw threaded parts directly into the housing.*

Fig. 6 · Attachment according to IEC 60534-6 (NAMUR)

4.3 Attachment according to VDI/VDE 3847

Type 3730-2xxxxxxxx0x00**6**0xx and Type 3730-2xxxxxxxx0x00**7**0xx Positioners with optional air purging of the actuator's spring chamber can be attached according to VDI/VDE 3847.

Type 3730-2xxxxxxxx0x00**0**0xx Positioner without optional air purging of the actuator's spring chamber can be attached according to VDI/VDE 3847.

This type of attachment allows the positioners to be replaced quickly while the process is running by blocking the air in the actuator.

The signal pressure can be blocked in the actuator by unscrewing the red retaining screw (20) and then turning the air blocker (19) on the bottom of the adapter block.

Attachment to Type 3277 Actuator (see Fig. 7)

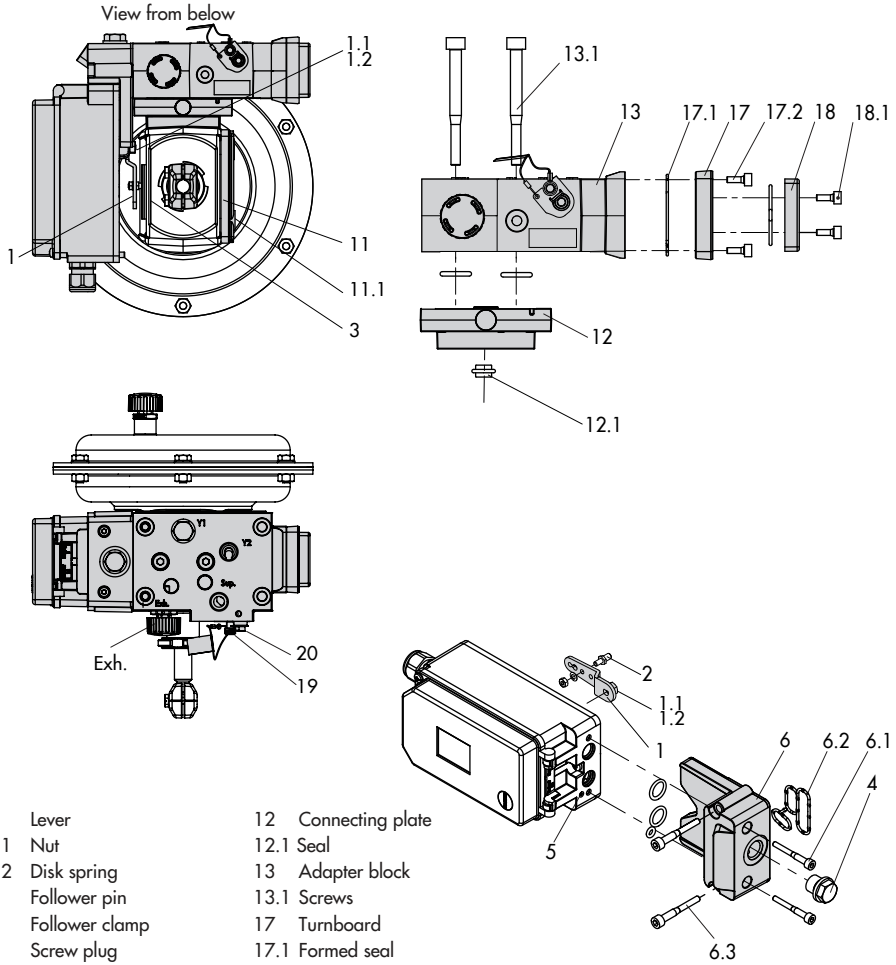
Refer to Table 4 on page 49 for the required mounting parts as well as the accessories.

Mount the positioner on the yoke as shown in Fig. 7. The signal pressure is routed to the actuator over the connecting plate (12), for actuators with fail-safe action "actuator stem extends" internally through a bore in the valve yoke and for "actuator stem retracts" through external piping.

Only the Y1 port is required for positioner attachment. The Y2 port can be used for air purging of the spring chamber.

1. Place follower clamp (3) on the actuator stem, align and screw tight so that the mounting screw is located in the groove of the actuator stem.
2. Place the adapter bracket (6) on the positioner and mount using the screws (6.1). Make sure that the seals are correctly seated. For positioners **with air purging**, remove the stopper (5) before mounting the positioner.
   For positioners **without air purging**, replace the screw plug (4) with a vent plug.
3. For actuators with 355/700/750 cm², remove the follower pin (2) at lever **M** (1) on the back of the positioner from pin position **35**, reposition it in the bore for pin position **50** and screw tight.
   For actuators 175, 240 and 350 cm² with 15 mm travel, the follower pin (2) remains in pin position **35**.
4. Insert formed seal (6.2) in the groove of the adapter bracket.
5. Insert the formed seal (17.1) into the turnboard (17) and mount the turnboard to the adapter block (13) using the screws (17.2).
6. Mount the blank plate (18) to the turnboard (17) using the screws (18.1) Make sure that the seals are correctly seated.

Note: *A solenoid valve can also be mounted in place of the blank plate (18). The orientation of the turnboard (17) determine the mounting position of the solenoid valve. Alternatively, a restrictor plate can be mounted (see AB 11 EN).*



1 Lever
1.1 Nut
1.2 Disk spring
2 Follower pin
3 Follower clamp
4 Screw plug
5 Stopper
6 Adapter bracket
6.1 Screws
6.2 Formed seal
6.3 Screws
11 Cover
11.1 Vent plug
12 Connecting plate
12.1 Seal
13 Adapter block
13.1 Screws
17 Turnboard
17.1 Formed seal
17.2 Screws
18 Blank plate
18.1 Screws
19 Air blocker
20 Retaining screw

Fig. 7 · Attachment according to VDI/VDE 3847 onto Type 3277 Actuator

7. Insert screws (13.1) through the middle holes of the adapter block (13).
8. Place the connecting plate (12) together with the seal (12.1) onto the screws (13.1) corresponding to the fail-safe action "actuator stem extends" or "actuator stem retracts".
   The fail-safe action that applies is determined by aligning the groove of the adapter block (13) with the groove of the connecting plate (12) (Fig. 8).

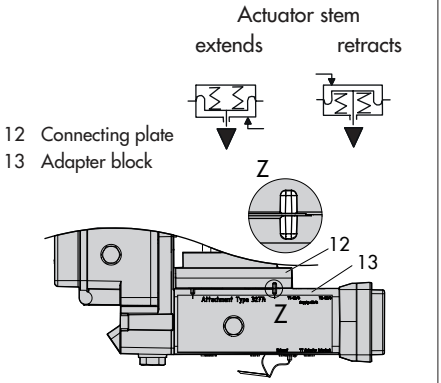


Fig. 8 · Fail-safe action

9. Mount the adapter block (13) together with the connecting plate (12) to the actuator using the screws (13.1).
10. Insert the vent plug (11.1) into the **Exh.** connection.
11. For fail-safe action "actuator stem extends", seal the Y1 port with a blanking plug.
    For fail-safe action "actuator stem retracts", connect the Y1 port to the signal pressure connection of the actuator.
12. Place the positioner on the adapter block (13) in such a manner that the follower pin (2) rests on the top of the follower clamp (3). Adjust the lever (1) correspondingly and open the positioner cover to hold the positioner shaft in position at the cap or the switch (Fig. 23). The lever (1) must rest on the follower clamp with spring force.
    Fasten the positioner to the adapter block (13) using the two fixing screws (6.3). Make sure the formed seal (6.2) is properly seated.
13. Mount cover (11) on the other side. Make sure that the vent plug points downwards when the control valve is installed to allow any condensed water that collects to drain off.

Attachment to NAMUR rib (see Fig. 9)

Refer to Table 4 on page 49 for the required mounting parts as well as the accessories. Note the travel table on page 19.

1. **Series 240 Valves, actuator size up to 1400-60 cm²:** Screw the two bolts (14) to the bracket of the stem connector or directly to the stem connector (depending on the version), place the follower plate (3) on top and use the screws (14.1) to fasten it.

   Type 3251 Valve, 350 to 2800 cm²: Screw the longer follower plate (3.1) to the bracket of the stem connector or directly to the stem connector (depending on the version).

   Type 3254 Valve, 1400-120 to 2800 cm²: Screw the two bolts (14) to the bracket (16). Fasten the bracket (16) onto the stem connector, place the follower plate (3) on top and use the screws (14.1) to fasten it.

Mount the positioner on the NAMUR rib as shown in Fig. 9.

2. For **attachment to the NAMUR rib**, fasten the NAMUR connection block (10) directly into the existing yoke bore using the screw and toothed lock washer (11). Align the marking on the NAMUR valve connection (on the side marked '1') to 50 % travel.
   For **attachment to valves with rod-type yokes**, use two U-bolts (15) around the stem.
   Fasten the NAMUR connection block (10) directly into the existing yoke bore using the screw and toothed lock washer (11). Align the marking on the NAMUR connection block (on the side marked '1') to 50 % travel.
3. Place the adapter bracket (6) on the positioner and mount using the screws (6.1). Make sure that the seals are correctly seated. For positioners **with air purging**, remove the stopper (5) before mounting the positioner.
   For positioners **without air purging**, replace the screw plug (4) with a vent plug.
4. Select required lever size (1) **M**, **L** or **XL** and pin position according to the actuator size and valve travels listed in the table on page 19.

Should you require a pin position other than position **35** with the standard installed lever **M**, or require a lever size **L** or **XL**, proceed as follows:

– Screw the follower pin (2) in the assigned lever bore (pin position) as listed in the table. Only use the longer follower pin (2) included in the mounting kit.
– Place lever (1) on the positioner shaft and screw tight using the disk spring (1.2) and nut (1.1).
– Move the lever once all the way as far as it will go in both directions.

5. Insert formed seal (6.2) in the groove of the adapter bracket.
6. Insert the formed seal (17.1) into the turnboard (17) and mount the turnboard to the adapter block (13) using the screws (17.2).

7. Mount the blank plate (18) to the turnboard (17) using the screws (18.1) Make sure that the seals are correctly seated.

Note: *A solenoid valve can also be mounted in place of the blank plate (18). The orientation of the turnboard (17) determine the mounting position of the solenoid valve. Alternatively, a restrictor plate can be mounted (see AB 11 EN).*

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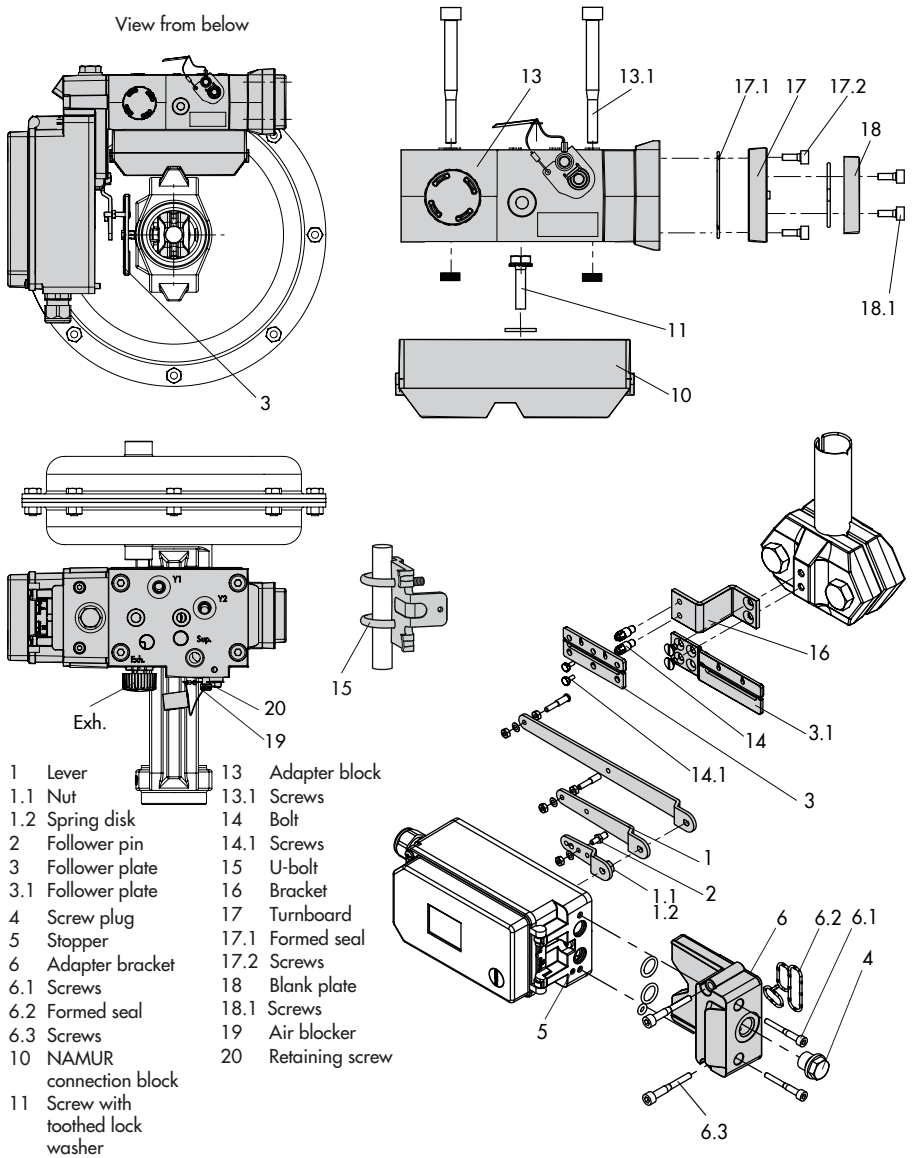
8. Mount the adapter block (13) to the NAMUR connection block using the screws (13.1).
9. Insert the vent plug (11.1) into the **Exh.** connection.
10. Place the positioner on the adapter block (13) in such a manner that the follower pin (2) rests on the top of the follower clamp (3). Adjust the lever (1) correspondingly.
    Fasten the positioner to the adapter block (13) using the two fixing screws (6.3). Make sure the formed seal (6.2) is properly seated.
11. **For single-acting actuators without air purging** connect the Y1 port of the adapter block to the signal pressure connection of the actuator. Seal the Y2 port with a blanking plug.
    For double-acting actuators and actuators with air purging connect the Y2 port of the adapter block to the signal pressure connection of the second actuator chamber or spring chamber of the actuator.



1 Lever
1.1 Nut
1.2 Spring disk
2 Follower pin
3 Follower plate
3.1 Follower plate
4 Screw plug
5 Stopper
6 Adapter bracket
6.1 Screws
6.2 Formed seal
6.3 Screws
10 NAMUR connection block
11 Screw with toothed lock washer
13 Adapter block
13.1 Screws
14 Bolt
14.1 Screws
15 U-bolt
16 Bracket
17 Turnboard
17.1 Formed seal
17.2 Screws
18 Blank plate
18.1 Screws
19 Air blocker
20 Retaining screw

Fig. 9 · Attachment according to VDI/VDE 3847 to the NAMUR rib

4.4 Attachment to Type 3510 Micro-flow Valve

Refer to Table 3 on page 49 for the required mounting parts as well as the accessories. Note the travel table on page 19.

The positioner is attached to the valve yoke using a bracket.

1. Screw bracket (9.1) to the stem connector (9).
2. Fasten the two pins (9.2) to the bracket (9.1) on the stem connector. Mount the follower plate (3) and fasten it using the screws (9.3).
3. Mount the travel indication scale (accessories) to the outer side of the yoke using the hex screws (12.1), ensuring that the scale is aligned with the stem connector.
4. Fasten the hex bar (11) onto the outer side of yoke by screwing the M8 screws (11.1) directly into the holes on the yoke.
5. Fasten the bracket (10) to the hex bar (11) using the hex screw (10.1), washer and tooth lock washer.
6. Mount connecting plate (6) or pressure gauge bracket (7) with pressure gauges (8) on the positioner, making sure both seal rings (6.1) are seated properly.
7. Unscrew the standard installed lever **M** (1) including follower pin (2) from the positioner shaft.
8. Take lever **S** (1) and screw follower pin (2) in the bore for pin position **17**.
9. Place lever **S** on the positioner shaft and screw tight using the disk spring (1.2) and nut (1.1).

   Move lever once all the way as far as it will go in both directions.
10. Place positioner on the bracket (10) in such a manner that the follower pin slides into the groove of the clamp (3). Adjust the lever (1) correspondingly. Screw the positioner to the bracket (10) using both its screws.

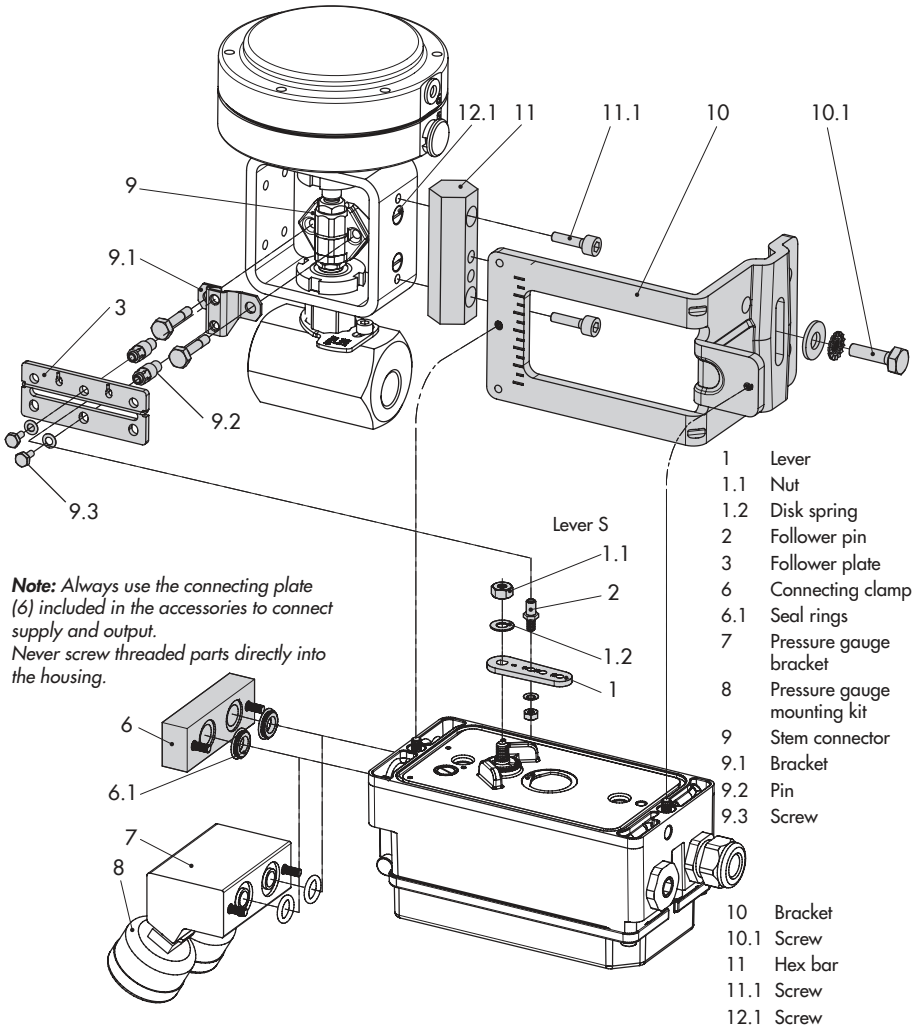


Fig. 10 · Attachment to Type 3510 Micro-flow Valve

4.5 Attachment to rotary actuators

Refer to Table 5 on page 50 for the required mounting parts as well as the accessories. Note the travel table on page 19.

The positioner is mounted to the rotary actuator using two pairs of double brackets.

Prior to attaching the positioner to the SAMSON Type 3278 Rotary Actuator, mount the associated adapter (5) to the free end of the rotary actuator shaft.

Note: *On attaching the positioner as described below, it is imperative that the actuator's direction of rotation is observed.*

---

1. Place follower clamp (3) on the slotted actuator shaft or the adapter (5).
2. Place coupling wheel (4) with flat side facing the actuator on the follower clamp (3). Refer to Fig. 12 to align slot so that it matches the direction of rotation when the valve is in its closed position.
3. Screw coupling wheel and follower clamp tightly onto the actuator shaft using screw (4.1) and disk spring (4.2).
4. Screw the bottom pair of brackets (10.1) with the bends pointing either to the inside or to the outside (depending on the actuator size) to the actuator case. Position top pair of brackets (10) and screw tight.
5. Mount connecting plate (6) or pressure gauge bracket (7) with pressure gauges to the positioner, making sure both O-rings are seated properly.
   For **double-acting**, springless rotary actuators, a reversing amplifier is required to attach the positioner to the actuator, see section 4.6.
6. Unscrew the standard follower pin (2) from the positioner's lever **M** (1). Use the metal follower pin (Ø5) included in the mounting kit and screw tight into the bore for pin position **90**°.
7. Place positioner on the top pair of brackets (10) and screw tight. Considering the actuator's direction of rotation, adjust lever (1) so that it engages in the slot of the coupling wheel (4) with its follower pin (see Fig. 12). It must be guaranteed that the lever (1) is parallel to the long side of the positioner when the actuator is at half its angle of rotation.
8. Stick scale plate (4.3) on the coupling wheel so that the arrow tip indicates the closed position, and it can be easily read when the valve is installed.

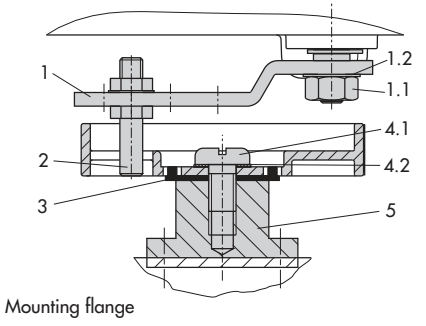
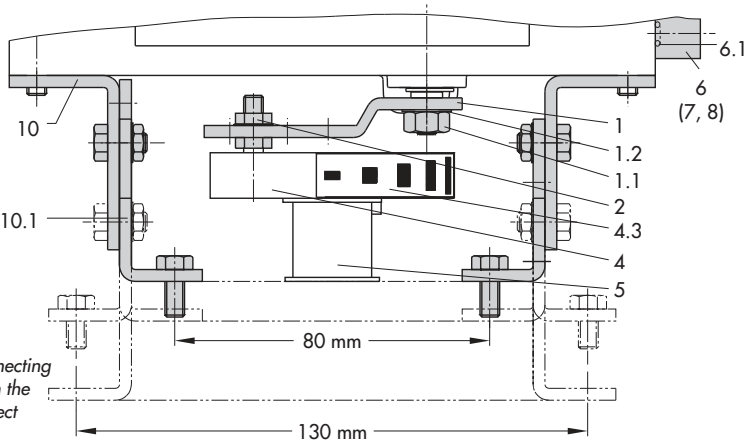
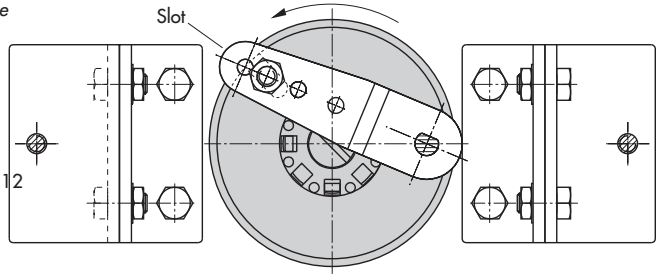


Fig. 11 · Mounting the coupling wheel with Type 3278



Note:
Always use the connecting plate (6) included in the accessories to connect supply and output. Never screw threaded parts directly into the housing.



Legends Figs. 11 + 12

1	Lever
1.1	Nut
1.2	Disk spring
2	Follower pin
3	Follower clamp (Fig. 11)
4	Coupling wheel
4.1	Screw
4.2	Disk spring
4.3	Scale plate
4.3	Scale plate
5	Actuator shaft Adapter for Type 3278
6.1	Seal rings
7	Pressure gauge bracket
8	Pressure gauge mounting kit
10	Top pair of brackets
10.1	Bottom pair of brackets

Fig. 12 · Attachment to rotary actuators

4.5.1 Heavy-duty version

Refer to Table 5 on page 50 for the required mounting parts as well as the accessories with their order numbers.

Both mounting kits contain all the necessary mounting parts. First select correct actuator size. Prepare actuator, and mount required adapter supplied by the actuator manufacturer, if necessary.

1. Mount the housing (10) onto the rotary actuator. In case of VDI/VDE attachment, place spacers (11) underneath, if necessary.
2. **For SAMSON Type 3278 and VETEC S160 Rotary Actuator**, screw the adapter (5) onto the free end of the shaft or place adapter (5.1) onto the shaft of the **VETEC R Actuator.**
   Place adapter (3) onto **Type 3278, VETEC S160 and VETEC R Actuator**. For **VDI/VDE version**, this step depends on the actuator size.
3. Stick adhesive label (4.3) onto the coupling wheel in such a manner that the yellow part of the sticker is visible in the window of the housing when the valve is OPEN. Adhesive labels with explanatory symbols are enclosed and can be stuck on the housing, if required.
4. Screw tight coupling wheel (4) onto the slotted actuator shaft or adapter (3) using screw (4.1) and disk spring (4.2).
5. Undo the standard follower pin (2) on the lever M (1) of the positioner. Attach the follower pin (Ø 5) included in the mounting kit to pin position 90°.
6. If applicable, mount pressure gauge bracket (7) with pressure gauges or, in case G ¼ threaded connections are required, the connecting plate (6), making sure both seal rings (6.1) are seated properly.
   For double-acting, springless rotary actuators, a reversing amplifier is required to attach the positioner to the actuator. Refer to section 4.6.
7. For actuators with a volume of less than 300 cm³, fit the screw-in restriction (order no.1400-6964) into the signal pressure output of the positioner (or the output of the pressure gauge bracket or connecting plate).
8. Place positioner on housing (10) and screw it tight. Considering the actuator's direction of rotation, align lever (1) so that it engages in the correct slot of the coupling wheel with its follower pin (Fig. 13).

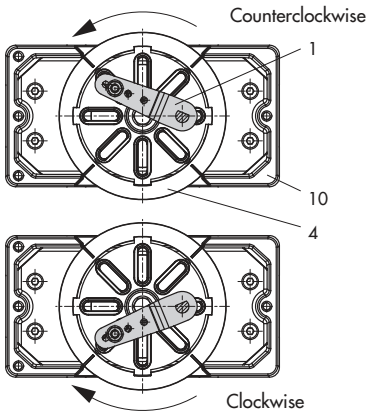


Fig. 13 · Direction of rotation

1 Lever
1.1 Nut
1.2 Disk spring
2 Follower pin
3 Adapter
4 Coupling wheel
4.1 Screw
4.2 Disk spring
4.3 Adhesive label
5 Actuator shaft or adapter
5.1 Adapter
6 Connecting plate (only for G ¼)
6.1 Seal rings
7 Pressure gauge bracket
8 Pressure gauge mounting kit
10 Adapter housing
10.1 Screws
11 Spacers

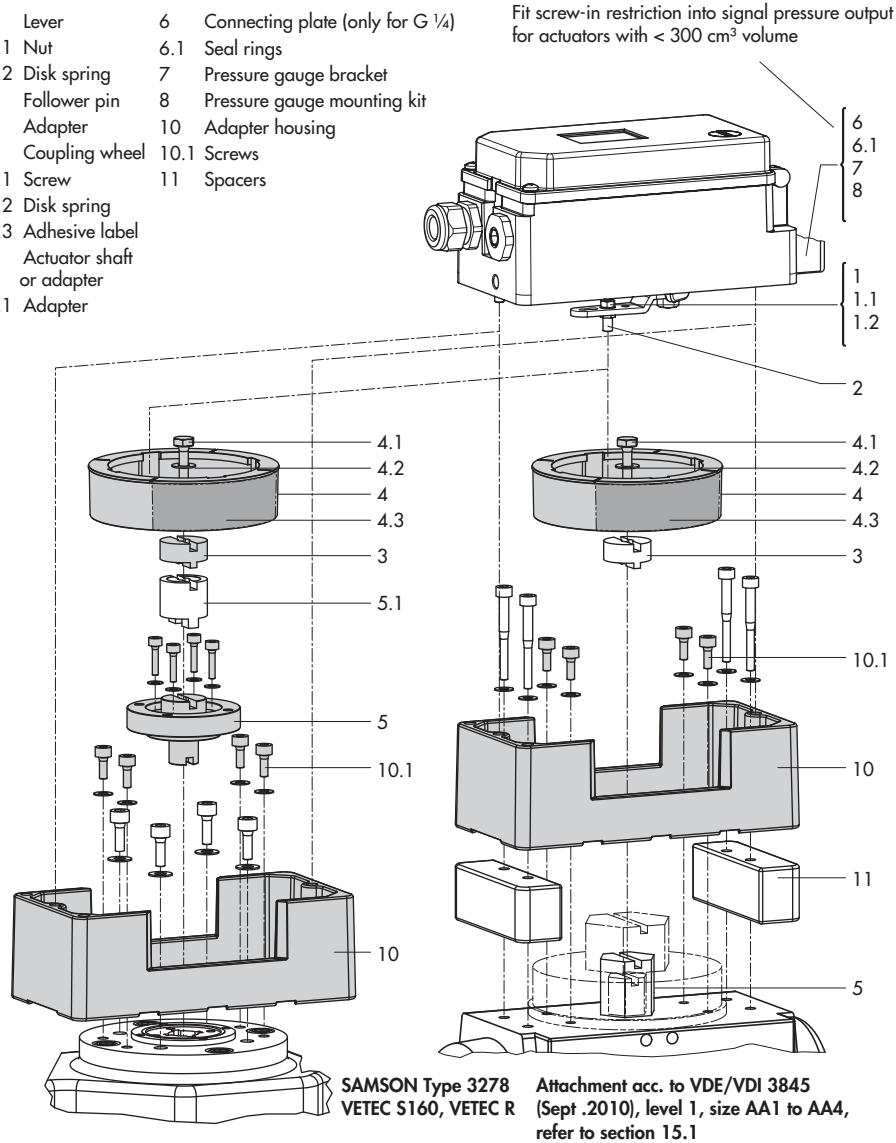


Fig. 14 · Attachment to rotary actuators (heavy-duty version)

4.6 Reversing amplifier for double-acting actuators

For the use with double-acting actuators, the positioner must be fitted with a reversing amplifier, e.g. the SAMSON Type 3710 Reversing Amplifier (see Mounting and Operating Instructions EB 8392 EN).

If a different reversing amplifier (item no. 1079-1118 or 1079-1119) is used, follow the mounting instructions described in section 4.6.1.

The following applies to all reversing amplifiers:

The output signal pressure of the positioner is supplied at the output **A_1** of the reversing amplifier. An opposing pressure, which equals the required supply pressure when added to the pressure at **A_1**, is applied at output **A_2**.
The rule **$A_1 + A_2 = Z$** applies.

A_1: Output **A_1** leading to the signal pressure connection at the actuator which opens the valve when the pressure increases

A_2: Output **A_2** leading to the signal pressure connection at the actuator which closes the valve when the pressure increases

- Set slide switch on positioner to **AIR TO OPEN**.

4.6.1 Reversing amplifier (1079-1118 or 1079-1119)

1. Mount the connecting plate (6) from the accessories in Table 5 to the positioner. Make sure that both O-rings (6.1) are seated correctly.
2. Thread the special nuts (1.3) from the accessories of the reversing amplifier into the boreholes of the connecting plate.
3. Insert the gasket (1.2) into the recess of the reversing amplifier and push both the hollowed special screws (1.1) into the connecting boreholes **A_1** and **Z**.
4. Place the reversing amplifier onto the connecting plate (6) and screw tight using both the special screws (1.1).
5. Use a screwdriver (8 mm wide) to screw the enclosed filters (1.6) into the connecting boreholes **A_1** and **Z**.

NOTICE
Do not unscrew the sealing plug (1.5) out of the reversing amplifier.
The rubber seal (1.4) is not required and can be removed when the sealing plug is used.

---

6. After the initialization is completed, set Code 16 (Pressure limit) to ***No***.

Pressure gauge attachment

The mounting sequence shown in Fig. 15 remains unchanged. Screw a pressure gauge bracket onto the connections **A_1** and **Z**.

Pressure gauge bracket:	G ¼	1400-7106
	¼ NPT	1400-7107

Pressure gauges for supply air Z and output A_1 as listed in Tables 1 to 7.

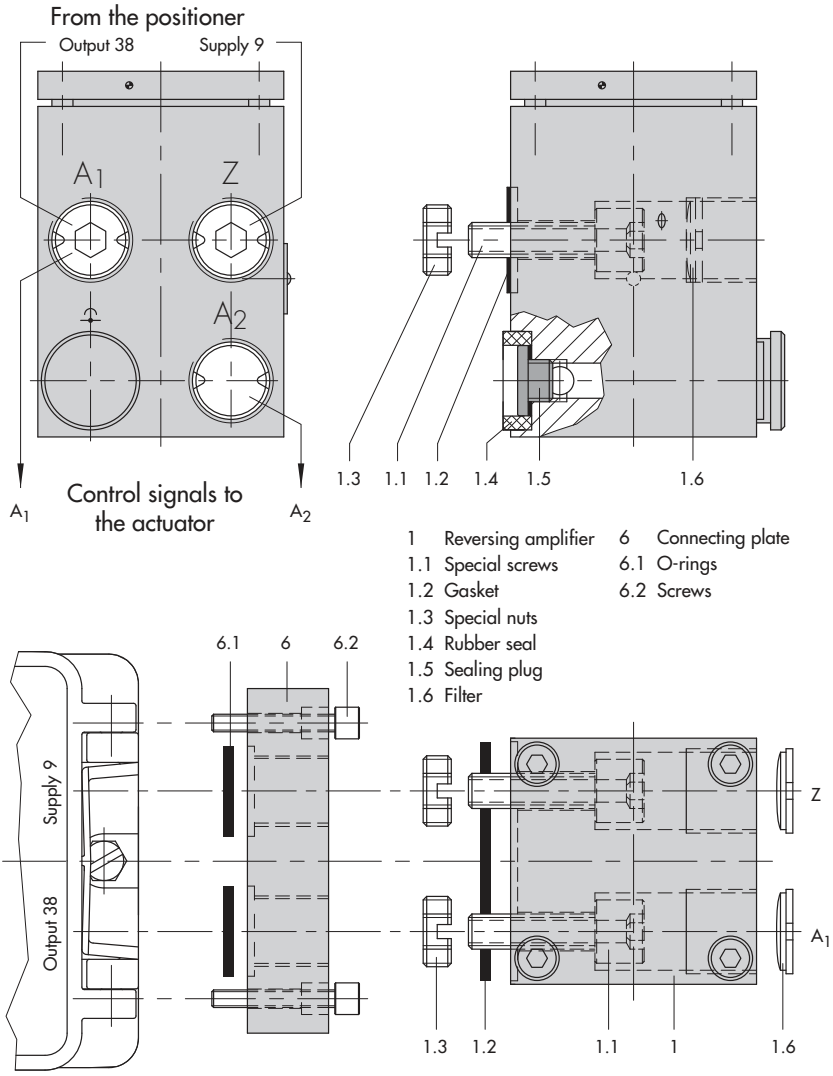


Fig. 15 · Mounting a reversing amplifier (1079-1118 or 1079-1119)

4.7 Attaching an external position sensor

Refer to Table 6 on p. 50 for the mounting parts as well as the accessories required.

In the positioner version with an external position sensor, the sensor placed in a separate housing is attached over a plate or bracket to the control valve. The travel pick-off corresponds to that of a standard device.
The positioner unit can be mounted as required to a wall or a pipe.

Fig. 16 · Positioner unit with sensor mounted on a micro-flow valve

For the pneumatic connection either a connecting plate (6) or a pressure gauge bracket (7) must be fixed to the housing, depending on the accessory chosen. Make sure the seal rings (6.1) are correctly inserted (see Fig. 6, bottom right).

For the electrical connection a 10 meter connecting lead with M12x1 connectors is included in the scope of delivery.

Note:

– *In addition, the instructions in sections 5.1 and 5.2 apply for the pneumatic and electrical connection.*
Operation and settings are described in sections 7 and 8.
– *Since 2009, the back of the position sensor (20) is fitted with two pins acting as mechanical stops for the lever (1). If this position sensor is mounted using old mounting parts, two corresponding Ø8 mm holes must be drilled into the mounting plate/bracket (21). A template is available for this purpose. Refer to Table 7 on page 51.*

4.7.1 Mounting the position sensor with direct attachment

Type 3277-5 Actuator with 120 cm²

The signal pressure from the positioner is routed over the signal pressure connection of the connecting plate (9, Fig. 17 left) to the actuator diaphragm chamber. To proceed, first screw the connecting plate (9) included in the accessories onto the actuator yoke.

- Turn the connecting plate (9) so that the correct symbol for the fail-safe position "Actuator stem extends" or "Actuator stem retracts" is aligned with the marking (Fig. 17, below).
- Make sure that the gasket for the connecting plate (9) is correctly inserted.
- The connecting plate has boreholes with NPT and G threads.
  Seal the threaded connection that is not used with the rubber seal and square plug.

Type 3277 Actuator with 175 to 750 cm²:

The signal pressure is routed to the connection at the side of the actuator yoke for the

version "Actuator stem extends".
For the fail-safe position "Actuator stem retracts" the connection on the top diaphragm case is used. The connection at the side of the yoke must be fitted with a venting plug (accessories).

Mounting the position sensor

1. Place the lever (1) on the sensor in mid-position and hold it in place. Unthread the nut (1.1) and remove the lever together with the disk spring (1.2) from the sensor shaft.
2. Screw the position sensor (20) onto the mounting plate (21).
3. Depending on the actuator size and rated valve travel, determine the required lever and position of the follower pin (2) from the travel table on page 19. The positioner is delivered with lever **M** in pin position **35** on the sensor. If necessary, remove the follower pin (2) from its pin position and move it to the borehole for the recommended pin position and screw tight.
4. Place the lever (1) and disk spring (1.2) on the sensor shaft.
   Place the lever (1) **in mid-position** and **hold it in place**. Screw on the nut (1.1).
5. Place the follower clamp (3) on the actuator stem, align and fasten it, making sure that the fastening screw rests in the groove of the actuator stem.
6. Place the mounting plate (21) together with the sensor onto the actuator yoke so that the follower pin (2) rests on the top

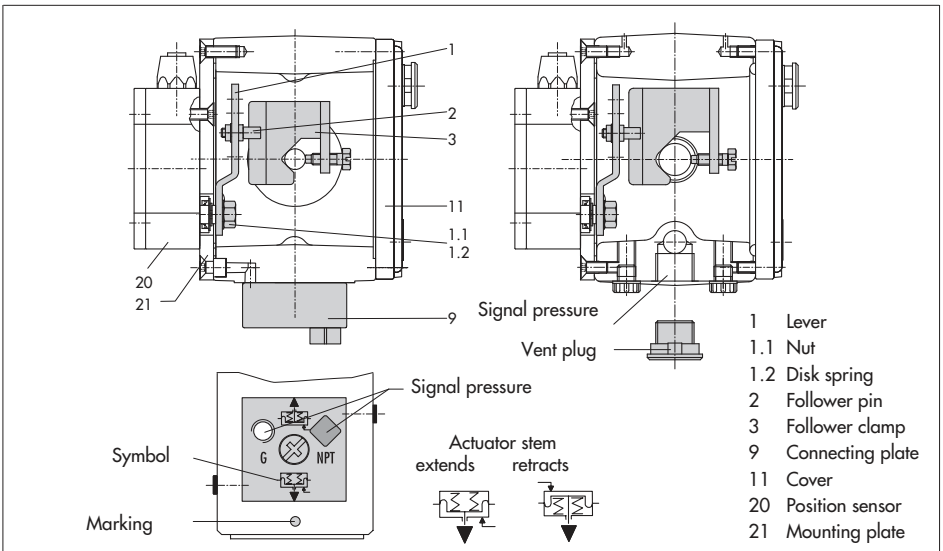


Fig. 17 · Mounting for Type 3277-5 Actuator (left) and Type 3277 Actuator (right)

of the follower clamp (3). It must rest on it with spring force.
Screw tight the mounting plate (21) onto the actuator yoke using both fixing screws.

7. Mount cover (11) on the other side. Make sure that the vent plug points downwards when the control valve is installed to allow any condensed water that collects to drain off.

4.7.2 Mounting the position sensor with attachment according to IEC 60534-6

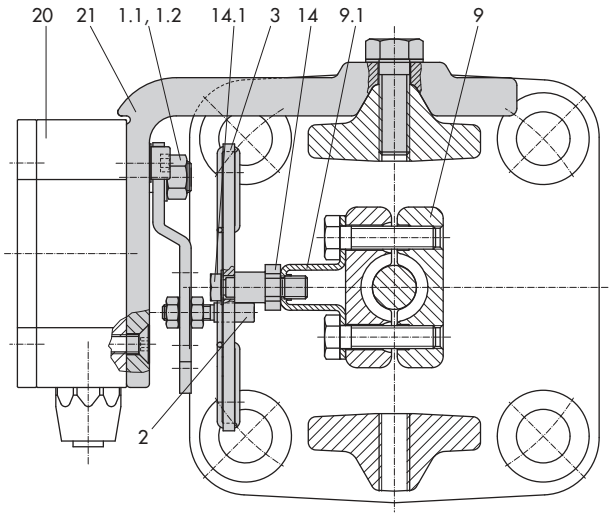
For the required mounting parts and the accessories, refer to Table 7 on page 51.

1. Place the lever (1) on the sensor **in mid-position** and **hold it in place**.
   Unthread the nut (1.1) and remove the lever together with the disk spring (1.2) from the sensor shaft.
2. Screw the position sensor (20) onto the bracket (21).

The standard attached lever **M** with the follower pin (2) at position **35** is designed for 120, 175, 240 and 350 cm² actuators with 15 mm rated travel.

For other actuator sizes or travels, select the lever and pin position from the travel table on page 19. Lever **L** and **XL** are included in the mounting kit.

3. Place the lever (1) and disk spring (1.2) on the sensor shaft.
   Place the lever (1) **in mid-position** and **hold it in place**. Screw on the nut (1.1).
4. Screw both bolts (14) to the bracket (9.1) of the stem connector (9). Attach



1 Lever
1.1 Nut
1.2 Disk spring
2 Follower pin
3 Follower plate
9 Stem connector
9.1 Bracket
14 Bolt
14.1 Screws
20 Position sensor
21 Bracket

Fig. 18 · Mounting according to IEC 60534-6 (NAMUR)

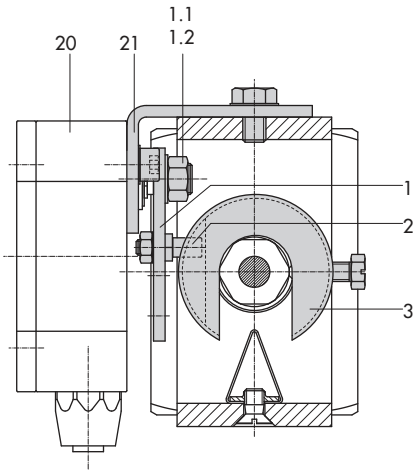
the follower plate (3) and fix with the screws (14.1).

5. Place the bracket with the sensor at the NAMUR rib in such a manner that the follower pin (2) rests in the slot of the follower plate (3), then screw the bracket using its fixing screws onto the valve.

4.7.3 Mounting the position sensor to Type 3510 Micro-flow Valve

For the required mounting parts and the accessories, refer to Table 7 on page 51.

1. Place the lever (1) **in mid-position** and **hold it in place**. Unscrew the nut (1.1) and remove the standard attached lever **M** (1) together with the disk spring (1.2) from the sensor shaft.
2. Screw the position sensor (20) onto the bracket (21).
3. Select the lever **S** (1) from the accessories and screw the follower pin (2) into the hole for pin position **17**.
   Place the lever (1) and disk spring (1.2) on the sensor shaft.
   Place the lever (1) in mid-position and hold it in place. Screw on the nut (1.1).
4. Place the follower clamp (3) on the stem connector, align it at a right angle and screw tight.
5. Position the bracket (21) with the position sensor on the valve yoke and screw tight, making sure the follower pin (2) slides into the groove of the follower clamp (3).



1 Lever
1.1 Nut
1.2 Disk spring
2 Follower pin
3 Follower clamp
20 Position sensor
21 Bracket

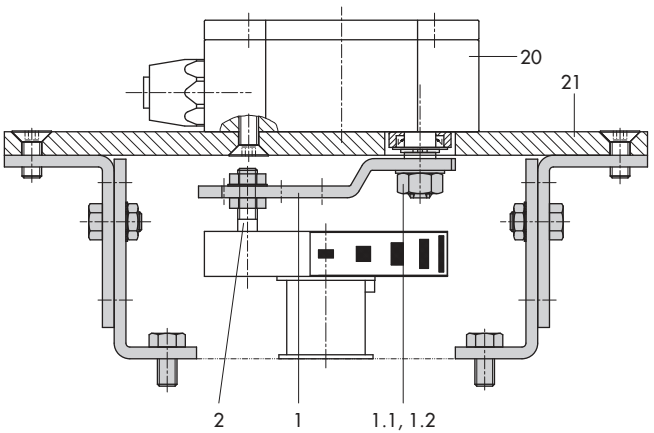
Fig. 19 · Mounting on a micro-flow valve

4.7.4 Mounting the position sensor to rotary actuators

For the required mounting parts and the accessories, refer to Table 7 on page 51.

1. Place the lever (1) **in mid-position** and **hold it in place**. Unscrew the nut (1.1) and remove the standard attached lever **M** (1) together with the disk spring (1.2) from the sensor shaft.
2. Screw the position sensor (20) onto the mounting plate (21).
3. Replace the follower pin (2) normally attached to the lever (1) with the metal follower pin (Ø 5) from the accessories and screw it into the hole for pin position 90°.
4. Place the lever (1) and disk spring (1.2) on the sensor shaft.
   Place the lever (1) **in mid-position** and **hold it in place**. Screw on the nut (1.1).

Follow the instructions describing attachment to the standard positioner in section 4.5 Instead of the positioner, attach the position sensor (20) with its mounting plate (21).



1 Lever
1.1 Nut
1.2 Disk spring
2 Follower pin
20 Position sensor
21 Mounting plate

Fig. 20 · Positioner unit with sensor mounted on rotary actuators

4.8 Mounting the leakage sensor

Normally, the control valve is delivered with positioner and leakage sensor already mounted.

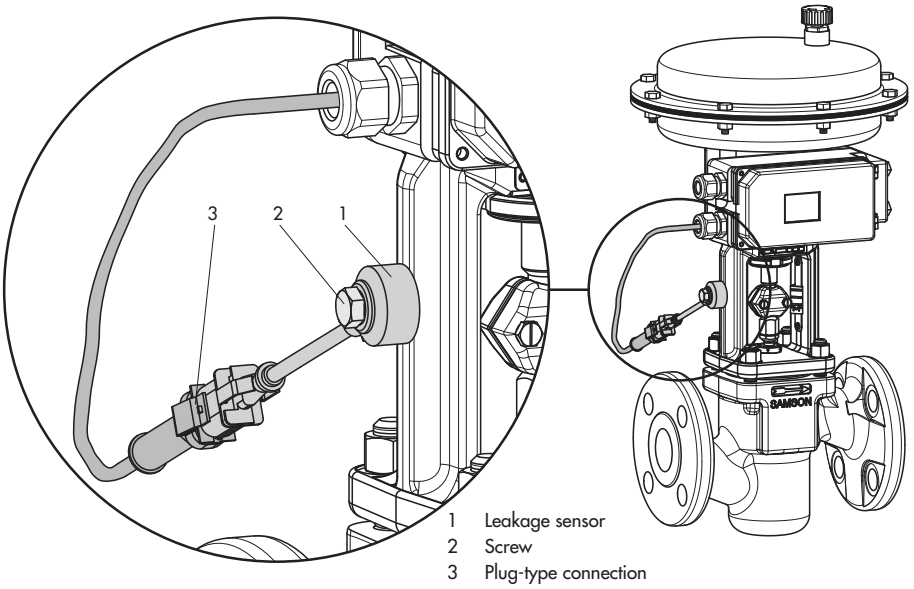
If the leakage sensor is mounted after the valve has been installed or it is mounted onto another control valve, proceed as described in following.

NOTICE
Fasten the leakage sensor using a torque of 20 ±5 Nm.

The hole with M8 thread on the NAMUR rib should preferably be used to mount the sensor (Fig. 21).

Note: *If the positioner was mounted directly onto the actuator (integral attachment), the NAMUR interfaces on either side of the valve yoke can be used to mount the leakage sensor.*

The start-up of the leakage sensor is described in detail in the Operating Instructions EB 8389 EN on EXPERTplus Valve Diagnostics.



1 Leakage sensor
2 Screw
3 Plug-type connection

Fig. 21 · Mounting the leakage sensor

4.9 Attaching positioners with stainless steel housings

Positioners with stainless steel housings require mounting parts that are completely made of stainless steel or free of aluminum.

Note: *The pneumatic connecting plate and a pressure gauge bracket made of stainless steel are available (order numbers listed below). The Type 3710 Pneumatic Reversing Amplifier is also available in stainless steel.*

Connecting plate (stainless steel):	G ¼	1400-7476
	¼ NPT	1400-7477
Pressure gauge bracket (st. steel):	G ¼	1402-0265
	¼ NPT	1400-7108

The Tables 1 to 6 (pages 47 to 50) apply for attaching positioners with stainless steel housings with the following restrictions:

Direct attachment
All mounting kits from Tables 1 and 2 can be used. The connection block is not required. The stainless steel version of the pneumatic connecting plate routes the air internally to the actuator.

Attachment according to IEC 60534-6 (NAMUR rib or attachment to rod-type yokes)
All mounting kits from Table 3 can be used. Connecting plate in stainless steel.

Attachment to rotary actuators
All mounting kits from Table 5 can be used except for the heavy-duty version. Connecting plate in stainless steel.

4.10 Air purging function for single-acting actuators

The exhaust air from the positioner is diverted to the actuator spring chamber to provide corrosion protection inside the actuator. The following must be observed:

Direct attachment to Type 3277-5 (stem extends FA/stem retracts FE)
The air purging function is automatically provided.

Direct attachment to Type 3277, 175 to 750 cm²
FA: Remove the stopper 12.2 (Fig. 5 on page 23) at the connection block and make a pneumatic connection to the spring chamber on the vented side.

NOTICE
The method described does not apply to old connection blocks in powder-paint-coated aluminum. In this case, follow the instructions for attachment described below in "Attachment acc. to IEC 60534-6 (NAMUR rib or attachment to rod-type yokes) and to rotary actuators".

FE: The air purging function is automatically provided.

Attachment acc. to IEC 60534-6 (NAMUR rib or attachment to rod-type yokes) and to rotary actuators
The positioner requires an additional port for the exhaust air that can be connected

over piping. An adapter available as an accessory is used for this purpose:

Threaded bushing (M20 x 1.5):	G ¼	0310-2619
	¼ NPT	0310-2550

NOTICE

*The adapter uses one of the M20 x 1.5 connections in the housing which means **just one** cable gland can be installed.*

Should other valve accessories be used which vent the actuator (e.g. solenoid valve, volume booster, quick exhaust valve), this exhaust air must also be included in the purging function. The connection over the adapter at the positioner must be protected with a check valve, e.g. check valve G ¼ (order no. 8502-0597) mounted in the piping. Otherwise the pressure in the positioner housing would rise above the ambient pressure and damage the positioner when the exhausting components respond suddenly.

4.11 Mounting parts and accessories

Table 1 · Direct attachment to Type 3277-5 Actuator (Fig. 4)			Order no.
Mounting parts	Standard version for actuators 120 cm² or smaller		1400-7452
	Version compatible with paint for actuators 120 cm² or smaller		1402-0940
Accessories for the actuator	Switchover plate **old** for Actuator Type 3277-5xxxxxx.**00** (old)		1400-6819
	Switchover plate **new** for Actuator Type 3277-5xxxxxx.**01** (new) [1]		1400-6822
	Connecting plate **new** for Actuator Type 3277-5xxxxxx.**01** (new) [1], G ⅛ and ⅛ NPT		1400-6823
	Connecting plate **old** for Actuator Type 3277-5xxxxxx.**00** (old): G ⅛		1400-6820
	Connecting plate **old** for Actuator Type 3277-5xxxxxx.**00** (old): ⅛ NPT		1400-6821
Accessories for the positioner	Connecting plate (6)	G ¼	1400-7461
		¼ NPT	1400-7462
	Pressure gauge bracket (7)	G ¼	1400-7458
		¼ NPT	1400-7459
	Pressure gauge mounting kit (8) up to max. 6 bar (output/supply)	St. steel/brass	1400-6950
		St. steel/St. st.	1400-6951

[1] Only new switchover and connecting plates can be used with new actuators (Index 01). Old and new plates are not interchangeable.

Table 2 · Direct attachment to Type 3277 (Fig. 5)					Order no.
Mounting parts	Standard version for actuators with 175, 240, 350, 355, 700, 750 cm²				1400-7453
	Version compatible with paint for actuators with 175, 240, 350, 355, 700, 750 cm²				1402-0941
Accessories	Required piping with screw fitting – for "Actuator stem retracts" – with air purging of the top diaphragm chamber	175 cm²	Steel	G ¼ / G ⅜	1402-0970
				¼ NPT / ⅜ NPT	1402-0976
			Stainl. steel	G ¼ / G ⅜	1402-0971
				¼ NPT / ⅜ NPT	1402-0978
		240 cm²	Steel	G ¼ / G ⅜	1400-6444
				¼ NPT / ⅜ NPT	1402-0911
			Stainl. steel	G ¼ / G ⅜	1400-6445
				¼ NPT / ⅜ NPT	1402-0912
		350 cm²	Steel	G ¼ / G ⅜	1400-6446
				¼ NPT / ⅜ NPT	1402-0913
			Stainl. steel	G ¼ / G ⅜	1400-6447
				¼ NPT / ⅜ NPT	1402-0914
		355 cm²	Steel	G ¼ / G ⅜	1402-0972
				¼ NPT / ⅜ NPT	1402-0979
			Stainl. steel	G ¼ / G ⅜	1402-0973
				¼ NPT / ⅜ NPT	1402-0980
		700 cm²	Steel	G ¼ / G ⅜	1400-6448
				¼ NPT / ⅜ NPT	1402-0915
			Stainl. steel	G ¼ / G ⅜	1400-6449
				¼ NPT / ⅜ NPT	1402-0916
		750 cm²	Steel	G ¼ / G ⅜	1402-0974
				¼ NPT / ⅜ NPT	1402-0981
			Stainl. steel	G ¼ / G ⅜	1402-0975
				¼ NPT / ⅜ NPT	1402-0982
	Connection block with seals and screw		G ¼		1400-8819
			¼ NPT		1400-8820
	Pressure gauge mounting kit (8) up to max. 6 bar (output/supply)		Steel/brass		1400-6950
			St. steel/St. steel		1400-6951

Table 3 · Attachment to NAMUR ribs or control valves with rod-type yokes (20 to 35 mm rod diameter) according to IEC 60534-6 (Figs. 6 and 10)				Order no.
Travel in mm	**Lever**	**For actuators**		
7.5	S	Type 3271-5 Actuator with 60/120 cm² on Type 3510 Valve (Fig. 10)		1402-0478
5 to 50	M [1]	Actuators from other manufacturers and Type 3271with 120 to 700 cm²		1400-7454
14 to 100	L	Actuators from other manufacturers and Type 3271, 1000 and 1400-60 versions		1400-7455
40 to 200	XL	Actuators from other manufacturers and Type 3271, versions 1400-120 and 2800 cm² with 120 mm travel		1400-7456
30 or 60	L	Type 3271, versions 1400-120 and 2800 cm² (30 or 60 mm travel)		1400-7466
		Mounting bracket for Emerson and Masoneilan linear actuators; a mounting kit acc. to IEC 60534-6 is necessary depending on the travel (see above)		1400-6771
		Valtek Type 25/50		1400-9554
Accessories	Connecting plate (6)		G ¼	1400-7461
			¼ NPT	1400-7462
	Pressure gauge bracket (7)		G ¼	1400-7458
			¼ NPT	1400-7459
	Pressure gauge mounting kit (8) up to max. 6 bar (output/supply)		St. st./Brass	1400-6950
			St. steel/St. st.	1400-6951

[1] Lever M is mounted on the standard positioner (included in the scope of delivery)

Table 4 · Attachment according to VDI/VDE 3847 (Figs. 7 and 9) **Type 3730-2xxxxxxxx0x0070xx** Electropneumatic Positioner with VDI/VDE 3847 interface		Order no.
Mounting parts	Interface adapter	1402-0257
	Mounting kit for attachment to SAMSON Type 3277with 175 to 750 cm²	1402-0868
	Mounting kit for attachment to SAMSON Type 3271 or non-SAMSON actuators	1402-0869
	Travel pick-off for valve travel up to 100 mm	1402-0177
	Travel pick-off for 100 to 200 mm valve travel (SAMSON Type 3271 only)	1402-0178

Table 5 · Attachment to rotary actuators (Figs. 11 and 12)			Order no.
Mounting parts	Attachment acc. to VDI/VDE 3845 (September 2010), refer to section 15.1 for details		
	Actuator surface corresponds to level 1 Size AA1 to AA4, version with CrNiMo steel bracket Size AA1 to AA4, heavy-duty version Size AA5, heavy-duty version (e.g. Air Torque 10 000)		 1400-7448 1400-9244 1400-9542
	Bracket surface corresponds to level 2, heavy-duty version		1400-9526
	Attachment for rotary actuators with max. 180° angle of rotation, level 2		1400-8815 and 1400-9837
	Attachment for SAMSON Type 3278 with 160/320 cm², CrNiMo steel bracket		1400-7614
	Attachment for SAMSON Type 3278 with 160 cm² and for VETEC Type S160, Type R and Type M, heavy-duty version		1400-9245
	Attachment for SAMSON Type 3278 with 320 cm² and for VETEC Type S320, heavy-duty version		1400-5891 and 1400-9526
	Attachment to Camflex II		1400-9120
Accessories	Connecting plate (6)	G ¼	1400-7461
		¼ NPT	1400-7462
	Pressure gauge bracket (7)	G ¼	1400-7458
		¼ NPT	1400-7459
	Pressure gauge mounting kit up to max. 6 bar (output/supply)	St. steel/brass	1400-6950
		St. steel/st. steel	1400-6951

Table 6 · General accessories				Order no.
Accessories	Pneumatic reversing amplifier for double-acting actuators			Type 3710
	Cable gland M20 x 1.5	Black plastic (6 to 12 mm clamping range)		8808-1011
		Blue plastic (6 to 12 mm clamping range)		8808-1012
		Nickel-plated brass (6 to 12 mm clamping range)		1890-4875
		Nickel-plated brass (10 to 14 mm clamping range)		1922-8395
		Stainless steel 1.4305 (8 to 14.5 mm clamping range)		8808-0160
	Adapter M20 x 1.5 to ½ NPT	Aluminum, powder paint coated		0310-2149
		Stainless steel		1400-7114
	Retrofit kit for inductive limit switch 1x SJ 2-SN			1400-7460
	Cover plate with list of parameters and operating instructions		German/English (standard)	1990-0761
			English/Spanish	1990-3100
			English/French	1990-3142

Table 7 · Attachment of external position sensor			Order no.
Template for mounting the position sensor on older mounting parts. See note on page 40.			1060-0784
Direct attachment	Mounting parts for actuators with 120 cm² see Fig. 17 left		1400-7472
	Connecting plate (9, old) for Actuator Type 3277-5xxxxxx.**00**	G ⅛	1400-6820
		⅛ NPT	1400-6821
	Connecting plate (new) for Actuator Type 3277-5xxxxxx.**01** (new) [1]		1400-6823
	Mounting parts for actuators with 175 to 750 cm², see Fig. 17 right		1400-7471
NAMUR attachmt.	Mounting parts for attachment to NAMUR rib w. lever L and XL, see Fig. 18		1400-7468
Attachment to Type 3510 Micro-flow Valve	Mounting parts for Type 3271 Actuator with 60 cm², see Fig. 19		1400-7469
Attachment to rotary actuators	VDI/VDE 3845 (September 2010), refer to section 15.1 for details		
	Actuator surface area corresponds to level 1 Size AA1 to AA4 with follower clamp and coupling wheel, version with CrNiMo steel bracket, see Fig. 20 Size AA1 to AA4, heavy-duty version Size AA5, heavy-duty version (e.g. Air Torque 10 000)		1400-7473 1400-9384 1400-9992
	Bracket surface area corresponds to level 2, heavy-duty version		1400-9974
	SAMSON Type 3278 with 160 cm² (also for VETEC Type S160 and Type R), heavy-duty version		1400-9385
	SAMSON Type 3278 with 320 cm² and for VETEC Type S320, heavy-duty version		1400-5891 and 1400-9974
Accessories for positioner	Connecting plate (6)	G ¼	1400-7461
		¼ NPT	1400-7462
	Pressure gauge bracket (7)	G ¼	1400-7458
		¼ NPT	1400-7459
	Pressure gauge mounting kit up to max. 6 bar (output/supply)	St. steel/brass	1400-6950
		St. steel/st. steel	1400-6951
	Bracket to mount the positioner on a wall **Note:** The other fastening parts are to be provided at the site of installation as wall foundations vary from site to site.		0309-0111

[1] Only new switchover and connecting plates can be used with new actuators (Index 01). Old and new plates are not interchangeable.

5 Connections

WARNING!
Mount the positioner, keeping the following sequence:
1. *Remove the protective film from the pneumatic connections*
2. *Mount the positioner on the control valve*
3. ***Connect the supply air***
4. ***Connect the electrical power***
5. *Perform the start-up settings*

The connection of the electrical auxiliary power may cause the actuator stem to move, depending on the operating mode.
Do not touch the actuator stem or obstruct it to avoid risk of injury to hands or fingers.

5.1 Pneumatic connections

NOTICE
Follow the instructions below to avoid damaging the positioner.
- *The threaded connections in the positioner housing are not designed direct air connection!*
- *The screw glands must be screwed into the connecting plate, the pressure gauge mounting block or the connection block from the accessories.*
  The air connections are optionally designed as a bore with ¼ NPT or G ¼ thread.
  The customary fittings for metal and copper pipes or plastic hoses can be used.
- *The supply air must be dry and free from oil and dust.*
  The maintenance instructions for upstream pressure reducing stations must be observed.
  Blow through all air pipes and hoses thoroughly prior to connecting them.

If the positioner is attached directly to the Type 3277 Actuator, the connection of the positioner's output pressure to the actuator is fixed. For attachment according to IEC 60534-6 (NAMUR), the signal pressure can be routed to either the top or bottom diaphragm chamber of the actuator, depending on the actuator's fail-safe action "actuator stem extends" or "actuator stem retracts".
For rotary actuators, the manufacturer's specifications for connection apply.

5.1.1 Signal pressure gauges

To monitor the supply air (Supply) and signal pressure (Output), we recommend that pressure gauges be attached (see accessories in Tables 1 to 7).

5.1.2 Supply pressure

The required supply air pressure depends on the bench range and the actuator's operating direction (fail-safe action).
The bench range is registered on the nameplate either as spring range or signal pressure range depending on the actuator. The direction of action is marked **FA** or **FE**, or by a symbol.

Actuator stem extends FA (air to open)

Fail-close
(for globe and angle valves):

Required supply pressure = Upper bench range value + 0.2 bar, minimum 1.4 bar.

Actuator stem retracts FE (air to close)

Fail-open
(for globe and angle valves):
For tight-closing valves, the maximum signal pressure pst_{max} is roughly estimated as follows:

$$pst_{max} = F + \frac{d^2 \cdot \pi \cdot \Delta p}{4 \cdot A} \text{ [bar]}$$

d = Seat diameter [cm]
Δp = Differential pressure across the valve [bar]
A = Actuator diaphragm area [cm^2]

If there are no specifications, calculate as follows:

Required supply pressure =
Upper bench range value + 1 bar.

5.1.3 Signal pressure (output)

The signal pressure at the output (Output 38) of the positioner can be limited to 1.4, 2.4 or 3.7 bar in Code **16**.

The limitation is not activated [No] by default.

5.2 Electrical connections

DANGER!
Risk of electric shock and/or the formation of an explosive atmosphere!

- *For electrical installation, observe the relevant electrotechnical regulations and the accident prevention regulations that apply in the country of use.*
- *The following regulations apply to mounting and installation in hazardous areas: EN 60079-14: 2008* ***Explosive atmospheres – Part 14: Electrical installations design, selection and erection*** *(or VDE 0165 Part 1).*

NOTICE
- *Adhere to the terminal assignment! Switching the assignment of the electrical terminals may cause the explosion protection to become ineffective!*
- *Do not loosen enameled screws in or on the housing.*
- *The maximum permissible values specified in the national EC type examination certificates apply when interconnecting intrinsically safe electrical equipment (U_i or U_o; I_i or I_o; P_i or P_o; C_i or C_o, and L_i or L_o).*

Selecting cables and wires:

Observe ***Clause 12 of EN 60079-14: 2008*** *when installing intrinsically safe circuits. The Subclause 12.2.2.7 applies when running multi-core cables containing more than one intrinsically safe circuit.*

In particular, the radial thickness of the conductor insulation for common insulation materials, such as polyethylene, must have a minimum radial thickness of 0.2 mm.

The diameter of an individual wire in a fine-stranded conductor must not be smaller than 0.1 mm. Protect the conductor ends against splicing, e.g. by using wire-end ferrules.

When two separate cables are used for connection, an additional cable gland can be installed.
Seal cable entries left unused with plugs.

Devices used at ambient temperatures ***below –20 °C*** *must be fitted with metal cable glands.*

Equipment for use in zone 2/zone 22

In equipment operated with type of protection Ex nA II (non-sparking equipment) according to EN 60079-15: 2003, circuits may be connected, interrupted or switched while energized only during installation, maintenance or repair.

Equipment connected to energy-limited circuits with type of protection Ex nL (energy-limited equipment) according to EN 60079-15: 2003 may be switched under normal operating conditions.

The maximum permissible values specified in the Statement of Conformity or its addenda apply when interconnecting the equipment with energy-limited circuits in type of protection Ex nL IIC.

Cable entries

The cable entry with M20 x 1.5 cable gland, 6 to 12 mm clamping range.
There is a second M20 x 1.5 threaded bore in the housing that can be used for additional connection, when required.

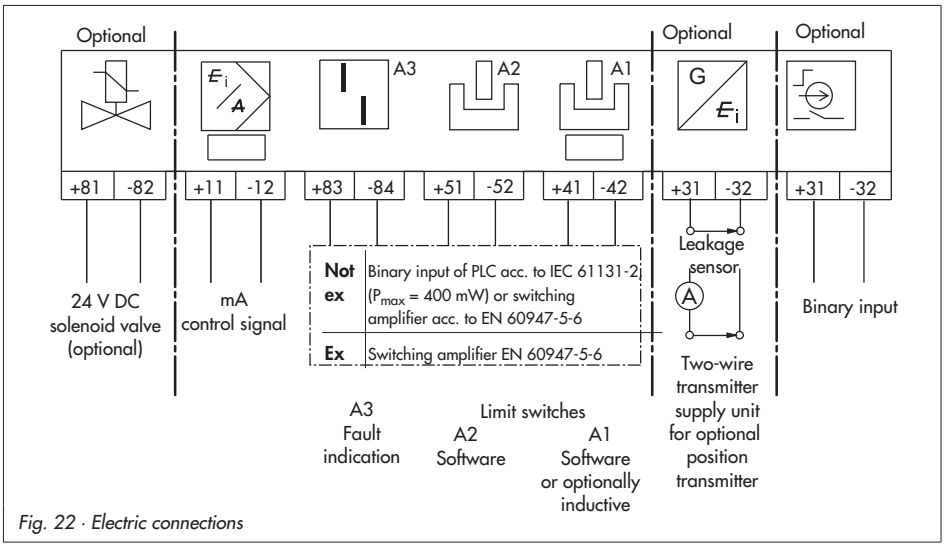


Fig. 22 · Electric connections

The screw terminals are designed for wire cross-sections of 0.2 to 2.5 mm². Tighten the screws by 0.5 to 0.6 Nm.

The wires for the reference variable must be connected to the terminals 11 and 12 located in the housing. Only use **a current source!**

If the reference variable exceeds 22 mA, ***OVERLOAD*** appears on the LC display to warn the user.

NOTICE
The wrong connection of a voltage source of just around 7 V (or around 2 V when connected to the wrong pole) by mistake can damage the positioner.

In general, it is not necessary to connect the positioner to a bonding conductor. Should this be required, however, this conductor can be connected inside the device. Depending on the version, the positioner is equipped with inductive limit switches and/or a solenoid valve.

The position transmitter is operated on a two-wire circuit. The usual supply voltage is 24 V DC. Considering the resistance of the supply leads, the voltage at the position transmitter terminals can be between 12 V and 30 V DC.
Refer to Fig. 22 or the label on the terminal strip for terminal assignment.

NOTICE
The minimum permissible reference variable should not fall below 3.8 mA for operating the positioner.

Accessories:

Cable gland M20 x 1.5	Order no.
Black plastic (6 to 12 mm clamping range)	8808-1011
Blue plastic (6 to 12 mm clamping range)	8808-1012
Nickel-plated brass (6 to 12 mm clamping range)	1890-4875
Nickel-plated brass (10 to 14 mm clamping range)	1922-8395
Stainless steel 1.4305 (8 to 14.5 mm clamping range)	8808-0160
Adapter M20 x 1.5 to ½ NPT	
Aluminum, powder paint coated	0310-2149
Stainless steel	1400-7114

5.2.1 Switching amplifiers

For operation of the limit switches, switching amplifiers must be connected in the output circuit. To ensure the operating reliability of the positioner, the amplifiers should comply with the limit values of the output circuits conforming to EN 60947-5-6.
If the positioner is to be installed in hazardous areas, the relevant regulations must be observed.

For applications in safe areas (non-hazardous areas), limit switches can be directly interconnected to the binary input of the PLC in accordance with IEC 61131. This applies to the standard operating range for digital inputs according to Clause 5.2.1.2 of IEC 61131-2 with the rated voltage of 24 V DC.

6 Operator controls and readings

Rotary pushbutton

The rotary pushbutton is located underneath the front protective cover.
The positioner is operated on site using the rotary pushbutton:

Turn to select codes and values.

Press to confirm setting.

Slide switch AIR TO OPEN or AIR TO CLOSE

- AIR TO OPEN applies when the increasing signal pressure opens the valve
- AIR TO CLOSE applies when the increasing signal pressure closes the valve

The signal pressure is the air pressure at the output of the positioner which is transferred to the actuator.

For positioners with an attached reversing amplifier for double-acting rotary actuators (section 4.6): switch position AIR TO OPEN.

Volume restriction Q

The volume restriction is used to adapt the air delivery to the actuator size. Two fixed settings are possible depending on how the air is routed at the actuator:

- For actuators smaller than 240 cm² with a loading pressure connection at the side (Type 3271-5) → MIN SIDE.
- For a connection at the back (Type 3277-5), → MIN BACK.
- For actuators 240 cm² and larger, → MAX SIDE for a side connection and to MAX BACK for a connection at the back.

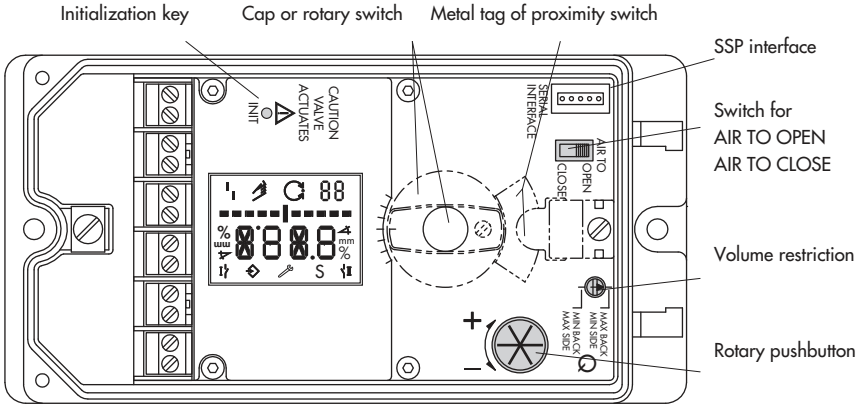


Fig. 23 · Operator controls

Readings on display

Icons appear on the display that are assigned to parameters, codes and functions.

Operating modes:

- **Manual mode** (MAN), section 8.2.1
  The positioner follows the manual set point (Code 1) instead of the mA signal
  blinks: The positioner has not yet been initialized. Operation only possible over manual set point (Code 1).
- **Automatic mode** (AUTO), section 8.2.1
  The positioner is in closed-loop operation and follows the mA signal.
- **S** – ***SAFE***, section 8.2.2
  The positioner vents the output. The valve moves to the mechanical fail-safe position.

Bar elements:

In manual and automatic modes, the bars indicate the system deviation that depends on the sign (+/–) and the value. One bar element appears per 1 % system deviation.
If the device has not yet been initialized, the icon blinks on the display and the lever position in degrees in relation to the longitudinal axis is indicated. One bar element corresponds to approximately a 5° angle of rotation.
If the fifth bar element blinks (reading > 30°), the permissible angle of rotation has been exceeded. Lever and pin position must be checked.

Status messages

- Maintenance alarm
- Maintenance required/Maintenance demanded
- blinks: Outside of specification

These icons indicate that an error has occurred.
A classified status can be assigned to each error. Classifications include “No message”, “Maintenance required”, “Maintenance demanded” and “Maintenance alarm“ (see section 8.3).

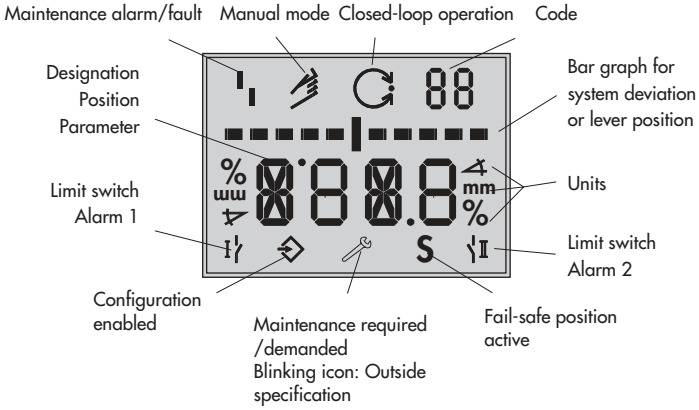
Configuration enabled

This indicates that the codes marked with an asterisk (*) in the code list (section 14) are enabled for configuration (see section 8.1).

6.1 Serial interface

The positioner must be supplied with at least 4 mA.
The positioner can be connected directly to the PC via the local serial interface and the serial interface adapter.

Use the TROVIS-VIEW software with 3730-2 device module installed.



Displays and their meaning

AUtO	Automatic mode
CL	Clockwise
CCL	Counterclockwise
Err	Error
ESC	Escape
HI	ix ≥ 21.6 mA
LO	ix ≤ 2.4 mA
LOW	w too small
MAN	Manual range
MAX	Maximum range
No	Not available/not active
NOM	Nominal travel
OVERLOAD	w > 22 mA
RES	Reset
RUN	Start
SAFE	Fail-safe position
SUb	Substitute calibration
tEStinG	Test function active
TunE	Initialization in progress

YES	Available/Active
ZP	Zero calibration
↗↗	Increasing/increasing
↗↘	Increasing/decreasing

blinking	Emergency mode (see error code **62**)
blinking	Not initialized
Sblinking	Valve in mechanical fail-safe position

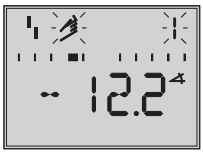
Fig. 24 · Display

7 Start-up – Settings

WARNING!
Mount the positioner, keeping the following sequence:
1. *Remove the protective film from the pneumatic connections*
2. *Mount the positioner on the control valve*
3. *Connect the supply air*
4. *Connect the electrical power*
5. ***Perform the start-up settings***

Reading on display after connecting the electrical auxiliary power:

- ***tEStinG*** runs across the display and then the fault alarm icon appears and blinks on the display when the positioner has **not yet been initialized**. The reading indicates the lever position in degrees in relation to the longitudinal axis.



Reading when the positioner has not yet been initialized

- If Code ***0*** appears on the display when a positioner has been **initialized**. The positioner is in the last active operating mode.

WARNING!
The actuator stem moves while the start-up settings are being performed.
Do not touch the actuator stem or obstruct it to avoid risk of injury to hands or fingers.

NOTICE
Perform the start-up settings in the same sequence as listed (section 7.1 to section 7.6).

Note: *The positioner performs a test in the start-up phase while following its automation task at the same time. During the start-up phase, operation on site is unrestricted, yet write access is limited.*

7.1 Defining the valve closed position

To adapt the positioner to the operating direction of the actuator, set slide switch to AIR TO OPEN or AIR TO CLOSE .

- **AIR TO OPEN** = Signal pressure opens the valve, for fail-safe position: actuator stem extends/fail close
- **AIR TO CLOSE** = Signal pressure closes the valve, for fail-safe position: actuator stem retracts/fail open.

NOTICE
*The AIR TO OPEN **(AtO)** setting always applies to double-acting actuators.*

For checking purposes:
After successfully completing initialization, the positioner display should read 0 % when the valve is closed and 100 % when the valve is open. If this is not the case, change the slide switch position and re-initialize the positioner.

Note: *The switch position is prompted prior to an initialization. After an initialization has been completed, changing the switch position does not have any effect on the operation of the positioner.*

7.2 Setting the volume restriction Q

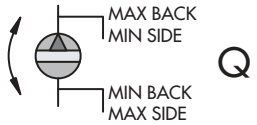


Fig. 25 · Volume restriction Q MAX BACK/MIN SIDE setting

The volume restriction Q is used to adapt the air delivery to the size of the actuator:

- Actuators with a **transit time < 1 s**, e.g. linear actuators with an effective area smaller than 240 cm², require a restricted air flow rate (MIN).
- Actuators with a **transit time ≥ 1 s** do not require the air flow rate to be restricted (MAX).

The position of volume restriction Q also depends on how the signal pressure is routed at the actuator in **SAMSON actuators**:

- The "SIDE" position applies for actuators with a loading pressure connection at the side, e.g. Type 3271-5.
- The "BACK" position applies for actuators with a loading pressure connection at the back, e.g. in Type 3277-5.
- The "SIDE"restriction position always applies for actuators from other manufacturers.

Overview · Position of volume restriction Q*

Signal pressure \ Transit time	< 1 s	≥ 1 s
Connection at the side	MIN SIDE	MAX SIDE
Connection at the back	MIN BACK	MAX BACK

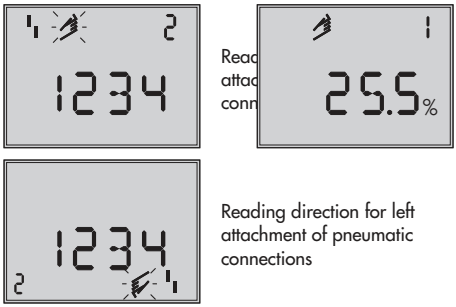
* Intermediate positions are not permitted.

NOTICE

The positioner needs to be initialized again after the position of the restriction has been changed.

7.3 Adapting the display

The data representation on the positioner display can be turned by 180° to adapt it to how the positioner is mounted.



Reading direction for left attachment of pneumatic connections

If the displayed data appear upside down, proceed as follows:

Turn ⊛ → Code ***2***

Press ⊛ → Code ***2*** blinks.

Turn ⊛ → Required direction

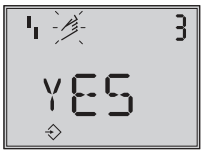
Press ⊛ to confirm reading direction.

7.4 Limiting the signal pressure

If the maximum actuator force may cause damage to the valve, the signal pressure must be limited.

Enable configuration at the positioner before activating the pressure limit function:

Note: *If no settings are entered within 120 seconds, the enabled configuration function becomes invalid.*



Configuration enabled
Default: ***No***

Turn ⊛ → Code **3**, display: ***No***

Press ⊛ → Code ***3*** blinks.

Turn ⊛ → ***YES***

Press ⊛ → display ⇨

Limiting the signal pressure:

Pressure limit
Default: ***No***

Turn ⊛ → Code **16**

Press ⊛ → Code ***16*** blinks.

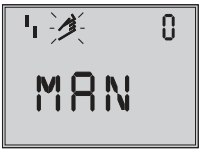
Turn ⊛ until the required pressure limit (1.4/2.4/3.7 bar) appears.

Press ⊛ to confirm the pressure limit setting.

7.5 Checking the operating range of the positioner

To check the mechanical attachment and the proper functioning, the valve should be moved through the operating range of the positioner in the ✋ manual operating mode with the manual reference variable.

Selecting ✋ manual operating mode:



Operating mode
Default ***MAN***

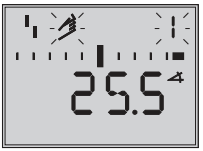
Turn ⊛ → Code **0**

Press ⊛ → Code ***0*** blinks.

Turn ⊛ → ***MAN***

Press ⊛. The positioner changes to the ✋ manual operating mode.

Checking the operating range:



Manual reference variable w (current angle of rotation is indicated)

Turn ⊛ → Code **1**

Press ⊛ → Code ***1*** and ✋ blink.

Turn ⊛ until the pressure in the positioner builds up, and the control valve moves to its final positions so that the travel/angle of rotation can be checked.

The angle of rotation on the back of the positioner is indicated. A horizontal lever (mid position) is equal to 0°.

To ensure the positioner is working properly, the outer bar elements may not blink while the valve is moving through the operating range.
Exit Code **1** by pressing the rotary pushbutton (⊛).

The permissible range has been exceeded when the displayed angle is greater than 30°, and the outer right or left bar element blinks.
The positioner changes to the fail-safe position (***SAFE***).
After canceling the fail-safe position (SAFE) (see section 8.2.2) it is **absolutely necessary** to **check** the lever and pin position as described in section 4.

WARNING!
To avoid personal injury or property damage caused by the supply air or electrical auxiliary power, disconnect the supply air and electrical auxiliary power before exchanging the lever or changing the pin position.

7.6 Initialization

WARNING!
During initialization, the control valve moves through its entire travel/rotation range. Therefore, do not start the initialization procedure while a process is running, but only during start-up when all shut-off valves are closed.

Before starting initialization, check the maximum permissible signal pressure of the control valve. During initialization, the positioner issues an output signal pressure up to the maximum supply pressure supplied. If necessary, limit the signal pressure by connecting an upstream pressure reducing valve.

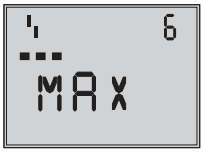
NOTICE
After the positioner has been mounted on to another actuator or its mounting location has been changed and prior to re-initializing the positioner, the positioner needs to be reset to its basic setting (default values). Refer to section 7.8.

During initialization the positioner adapts itself optimally to the friction conditions and the signal pressure demand of the control valve. The type and extent of self-adaptation depends on the set initialization mode:

- ***MAX* maximum range** (standard range)
  Initialization mode for simple start-up of valves with two clearly defined mechanical end positions, e.g. three-way valves (see section 7.6.1)

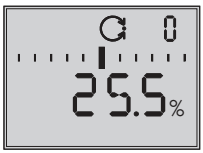
- ***NOM* nominal range**
  Initialization mode for all globe valves (see section 7.6.2)
- ***MAN* manually selected range**
  Initialization mode for globe valves with an unknown nominal range (see section 7.6.3)
- ***SUB* substitute calibration** (emergency mode)
  This mode allows a positioner to be replaced while the plant is running, with the least amount of disruption to the plant (see section 7.6.4)

Note: *For normal operation, simply start initialization by pressing the INIT key after mounting the positioner on the valve, defining the valve closed position and setting the volume restriction. The positioner only needs to work with its default settings. If necessary, perform a reset (see section 7.8).*



Alternating displays
Initialization running
Icon depending on initialization mode selected

Bar graph display indicating the progress of the initialization



Initialization successful, positioner in automatic operating mode

The time required for an initialization process depends on the transit time of the actuator and may take several minutes.

After a successful initialization, the positioner runs in closed-loop operation indicated by ↻.

A malfunctioning leads to the process being canceled. The initialization error appears on the display according to how it has been classified by the condensed state. See section 8.3.

Note: *The setting Code **48 - h0** = YES causes the reference graphs (drive signal steady-state d1 and hysteresis d2) to be plotted automatically after initialization has been completed. **tESt d1** or **tESt d2** appear on the display in an alternating sequence. An error during the plotting of the reference graphs is indicated by Code **48 - h1** and Code **81**.*
The positioner still works properly, even though the reference graph plotting has not been completed successfully.

Valve closed position AIR TO CLOSE

If the slide switch is set to AIR TO CLOSE, the positioner automatically switches to the direction of action increasing/decreasing (↗↘) on successful completion of initialization.
This results in the following assignment between reference variable and valve position:

Valve closed position	Direction of action	Valve Closed at	Open at
AIR TO OPEN	↗↗	0 %	100 %
AIR TO CLOSE	↗↘	100 %	0 %

The tight-closing function is activated.

NOTICE
*Set Code **15** (final position w>) to 99 % for three-way valves.*

Canceling an initialization process

The initialization procedure can be canceled while running by pressing the rotary pushbutton (⊛). **StOP** appears three seconds long and the positioner then changes to the fail-safe position (SAFE).

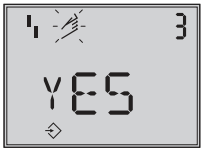
Exit the fail-safe position again over Code **0** (see section 8.2.2).

7.6.1 MAX – Initialization based on maximum range

The positioner determines travel/angle of rotation of the closing member from the CLOSED position to the opposite side and adopts this travel/angle of rotation as the operating range from 0 to 100 %.

Enable configuration:

***Note:** If no settings are entered within 120 seconds, the enabled configuration function becomes invalid.*



Default ***No***

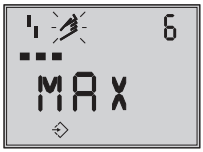
Turn ⊛ → Code ***3***, display: ***No***

Press ⊛ → Code ***3*** blinks

Turn ⊛ → ***YES***

Press ⊛, display ⇨

Select the initialization mode:



Initialization mode
Default ***MAX***

Turn ⊛ → Code ***6***

Press ⊛

Turn ⊛ → ***MAX***

Press ⊛ to confirm the ***MAX*** as the initialization mode.

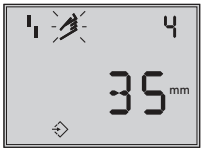
Start initialization:

- Press INIT key to start initialization!

The nominal travel/angle of rotation is indicated in % after initialization. Code ***5*** (nominal range) remains locked. The parameters for travel/angle range start (Code ***8***) and travel/angle range end (Code ***9***) can also only be displayed and modified in %.

For a reading in mm/°, enter the pin position (Code ***4***).

Enter the pin position:



Pin position
Default ***No***

Turn ⊛ → Code ***4***

Press ⊛, Code ***4*** blinks

Turn ⊛ → Pin position on lever (see relevant section on attachment)

Press ⊛. The reading of the nominal range appears in mm/°.

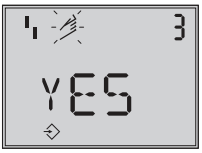
7.6.2 NOM – Initialization based on nominal range

The calibrated sensor allows the effective valve travel to be set very accurately. During the initialization process, the positioner checks whether the control valve can move through the indicated nominal range (travel or angle) without collision.
If this is the case, the indicated nominal range is adopted with the limits of travel/angle range start (Code **8**) and travel/angle range end (Code **9**) as the operating range.

Note: *The maximum possible travel must always be greater than the nominal travel entered. If this is not the case, initialization is interrupted (error alarm Code **52**) because the nominal travel is not achieved.*

Enable configuration:

Note: *If no settings are entered within 120 seconds, the enabled configuration function becomes invalid.*



Default ***No***

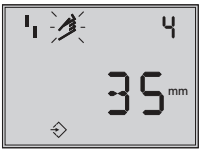
Turn ⊛ → Code ***3***, display: ***No***

Press ⊛, Code ***3*** blinks

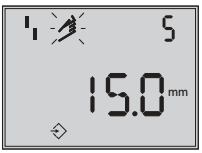
Turn ⊛ → ***YES***

Press ⊛, display ⇳

Enter the pin position and nominal range:



Pin position
Default ***No***



Nominal range
(locked with Code **4** = No)

Turn ⊛ → Code ***4***

Press ⊛, Code ***4*** blinks

Turn ⊛ → Pin position on lever (see relevant section on attachment)

Press ⊛.

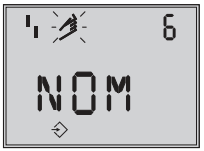
Turn ⊛ → Code ***5***

Press ⊛, Code ***5*** blinks

Turn ⊛ → Nominal travel/angle

Press ⊛.

Select the initialization mode:



Initialization mode
Default ***MAX***

Turn ⊛ → Code ***6***

Press ⊛, Code ***6*** blinks

Turn ⊛ → ***NOM***

Press ⊛ to confirm the ***NOM*** as the initialization mode.

Start initialization:

- Press INIT key to start initialization!

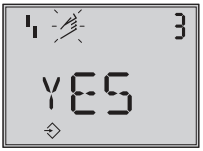
Note: *After initialization, check the direction of action and, if necessary, change it (Code **7**).*

7.6.3 MAN – Initialization based on a manually selected range

Before starting initialization, move the control valve manually to the OPEN position by turning ⊛ in small steps. The valve must move to the required valve position with a monotonically increasing signal pressure. The positioner calculates the differential travel/angle using the OPEN and CLOSED positions and adopts it as the operating range with limits of travel/angle range start (Code ***8***) and travel/angle range end (Code ***9***).

Enable configuration:

Note: *If no settings are entered within 120 seconds, the enabled configuration function becomes invalid.*



Default ***No***

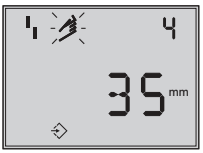
Turn ⊛ → Code ***3***, display: ***No***

Press ⊛, Code ***3*** blinks

Turn ⊛ → ***YES***

Press ⊛, display ⇨

Enter the pin position:



Pin position
Default ***No***

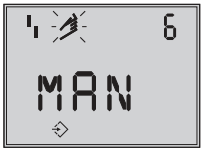
Turn ⊛ → Code ***4***

Press ⊛, Code ***4*** blinks

Turn ⊛ → Pin position on lever (see relevant section on attachment)

Press ⊛. The reading of the nominal range appears in mm/°.

Select the initialization mode:



Initialization mode
Default ***MAX***

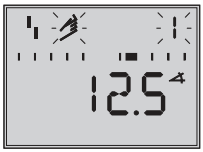
Turn ⊛ → Code ***6***

Press ⊛, Code ***6*** blinks

Turn ⊛ → ***MAN***

Press ⊛ to confirm the ***MAN*** as the initialization mode.

Enter OPEN position:



Manual reference variable (the current angle of rotation is displayed)

Turn ⊛ → Code ***0***

Press ⊛, Code ***0*** blinks

Turn ⊛ → ***MAN***

Press ⊛.

Turn ⊛ → Code ***1***

Press ⊛, Code ***1*** blinks

Turn ⊛ until the valve reaches its OPEN position.

Press ⊛ to confirm the OPEN position.

Start initialization:

- Press INIT key to start initialization!

7.6.4 SUb substitute calibration

A complete initialization procedure takes several minutes and requires the valve to move through its entire travel range several times. This initialization mode, however, is an emergency mode, in which the control parameters are estimated and not determined by an initialization procedure. As a result, a high level of accuracy cannot be expected. You should always select a different initialization mode if the plant allows it.

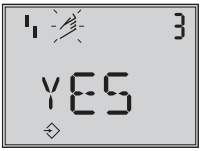
The ***SUb*** initialization mode is used to replace a positioner while the process is running. For this purpose, the control valve is usually fixed mechanically in a certain position, or pneumatically by means of a pressure signal which is routed to the actuator externally. The blocking position ensures that the plant continues to operate with this valve position.

By entering the blocking position (Code ***35***), closing direction (Code ***34***), pin position (Code ***4***), nominal range (Code ***5***) and direction of action (Code ***7***), the positioner can calculate the positioner configuration.

NOTICE
Perform a reset before re-initializing the positioner if the substitute positioner has already been initialized. Refer to section 7.8.

Enable configuration:

Note: *If no settings are entered within 120 seconds, the enabled configuration function becomes invalid.*



Default ***No***

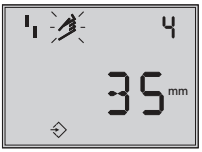
Turn ⊛ → Code ***3***, display: ***No***

Press ⊛, Code ***3*** blinks

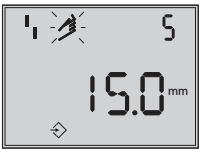
Turn ⊛ → ***YES***

Press ⊛, display ⇨

Enter the pin position and nominal range:



Default ***No***



Nominal range
(locked with Code **4** = No)

Turn ⊛ → Code ***4***

Press ⊛, Code ***4*** blinks

Turn ⊛ → Pin position on lever (see relevant section on attachment)

Press ⊛.

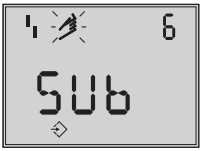
Turn ⊛ → Code ***5***

Press ⊛, Code ***5*** blinks

Turn ⊛ → Nominal travel/angle

Press ⊛.

Select the initialization mode:



Initialization mode
Default ***MAX***

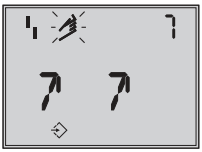
Turn ⊛ → Code ***6***

Press ⊛, Code ***6*** blinks

Turn ⊛ → ***SUb***

Press ⊛ to confirm the ***SUb*** as the initialization mode.

Enter the direction of action:



Default ↗↗

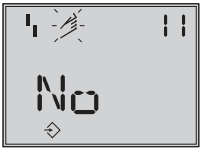
Turn ⊛ → Code ***7***

Press ⊛, Code ***7*** blinks

Turn ⊛ → Direction of action (↗↗ or ↗↘)

Press ⊛.

Deactivate travel limit:



Default ***100.0***

Turn ⊛ → Code ***11***

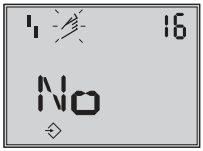
Press ⊛, Code ***11*** blinks

Turn ⊛ → ***No***

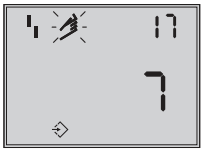
Press ⊛.

Change pressure limit and control parameters:

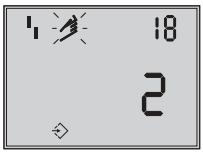
__Note:__ Do not change the pressure limit (Code __16__). Only change the control parameters K_P (Code __17__) and T_V (Code __18__) if the settings of the replaced positioner are known.



Pressure limit
Default ***No***



KP
Default ***7***



TV
Default ***2***

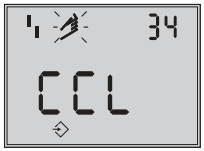
Turn ⊛ → Code ***16/17/18***

Press ⊛, Code ***16/17/18*** blinks

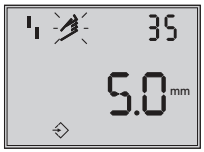
Turn ⊛ to set the control parameter selected.

Press ⊛ to confirm the setting.

Enter closing direction and blocking position:



Closing direction
Direction of rotation causing the valve to move to the CLOSED position (view onto positioner display)
Default: CCL (counterclockwise)



Blocking position
Default: 0

Turn ⊛ → Code ***34***

Press ⊛, Code ***34*** blinks

Turn ⊛ → Closing direction (CCL counterclockwise/CL clockwise)

Press ⊛.

Turn ⊛ → Code ***35***

Press ⊛, Code ***35*** blinks

Turn ⊛ → Blocking position, e.g. 5 mm (read off at travel indicator scale of the blocked valve or measure with a ruler).

Press ⊛ to confirm the setting.

Define the valve end position:

- Set switch for **valve end position** AIR TO OPEN or AIR TO CLOSE as described in section 7.1 on page 59.
- Set volume restriction as described in section 7.2 on page 60.

Start initialization:

- Press INIT key!
  The operating mode is changed to ***MAN***.
  The blocking position is indicated.

Note: *As initialization has not been carried out completely, the error code **76** (no emergency mode) and possibly also error code **57** (control loop) may appear on the display.*
These alarms do not influence the positioner's readiness for operation.

Cancel the blocking position and change to automatic operating mode

For the positioner to follow its reference variable again, the blocking position must be canceled and the positioner must be set to ↻ automatic operating mode as follows:

Turn ⊛ → Code ***1***

Press ⊛, Code ***1*** and ⇗ blink

Turn ⊛ in order to move the valve slightly past the blocking position.

Press ⊛ to cancel mechanical blocking.

Turn ⊛ → Code ***0***

Press ⊛, Code ***0*** blinks.

Turn ⊛ → ***AUtO***

Press ⊛. The positioner switches to automatic operating mode. The current valve position is indicated in %.

Note: *If the positioner shows a tendency to oscillate in automatic operating mode, the parameters K_P and T_V must be slightly corrected. Proceed as follows:*
*Set T_V to 4 (Code **18**).*
*If the positioner still oscillates, the gain K_P (Code **17**) must be decreased until the positioner shows a stable behavior.*

Zero point calibration

Finally, if process operations allow it, the zero point must be adjusted according to section 7.7.

7.7 Zero calibration

In case of discrepancies with the closing position of the valve, e.g. with soft-sealed plugs, it may become necessary to recalibrate the zero point.

NOTICE
The valve briefly moves from the current travel/angle of rotation position to the closed position.

Note: *The positioner must be connected to the supply air to perform the zero calibration.*

Enable configuration:

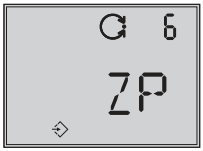
Turn ⊛ → Code **3**, display: **No**

Press ⊛, Code **3** blinks

Turn ⊛ → ***YES***

Press ⊛, display ⇨

Perform zero calibration:



Initialization mode
Default ***MAX***

Turn ⊛ → Code ***6***

Press ⊛, Code **6** blinks

Turn ⊛ → ***ZP***

Press ⊛.

▶ **Press INIT key!**

Zero calibration is started, the positioner moves the control valve to the CLOSED position and readjusts the internal electrical zero point.

7.8 Reset to default values

This function resets all parameters to the factory default values (see code list in section 14).

Enable configuration:

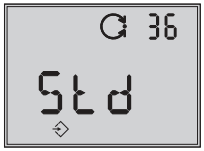
Turn ⊛ → Code **3**, display: ***No***

Press ⊛, Code **3** blinks

Turn ⊛ → ***YES***

Press ⊛, display ⇳

Reset start-up parameters:



Reset
Default ***No***

Turn ⊛ → Code ***36***, display: ••–••–

Press ⊛, Code **36** blinks

Turn ⊛ → ***Std***

Press ⊛. All start-up parameters and the diagnosis are reset to their default values.

Note: *Code **36 - diAG** allows just the diagnosis data (EXPERTplus) to be reset. Refer to EB 8389 EN on EXPERTplus valve diagnostics.*

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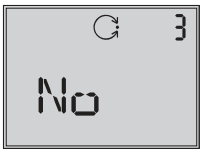
8 Operation

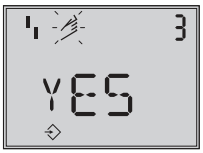
WARNING!
The actuator stem moves while the positioner is being operated.
Do not touch the actuator stem or obstruct it to avoid risk of injury to hands or fingers.

8.1 Enabling and selecting parameters

The codes which are marked with an asterisk (*) in section 14 on page 81 onwards must be enabled with Code **3** before the associated parameters can be configured as described below.



Code ***3***
Configuration
not enabled



Configuration
enabled

Turn ⊛ → Code **3**, display: ***No***

Press ⊛, Code ***3*** blinks.
Change the setting of Code ***3***.

Turn ⊛ → ***YES***

Press ⊛, display: ⇨
The configuration is enabled.

You can now configure codes one after the other:

Turn ⊛ and select the required code.

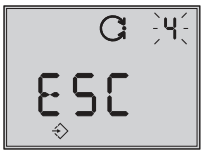
Press ⊛ to access the selected code. The code number starts to blink.

Turn ⊛ and select the setting.

Press ⊛ to confirm the selected setting.

Note: *If no settings are entered within 120 seconds, the enabled configuration function becomes invalid and the display changes to Code **0**.*

Cancel the setting:



Canceling the setting

To cancel a value before it is confirmed (by pressing ⊛) proceed as follows:

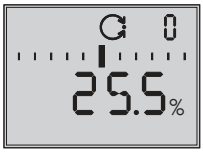
Turn ⊛ → ***ESC***

Press ⊛. The entered value is not adopted.

8.2 Operating modes

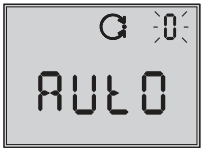
8.2.1 Automatic and manual modes

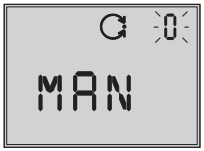
After initialization has been completed successfully, the positioner is in ↻ automatic mode.



↻ automatic mode

Switch to ☞ manual operating mode





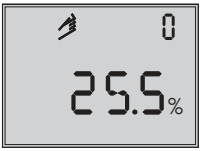
Turn ⊛ → Code **0**

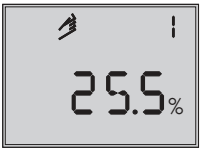
Press ⊛, display: ***AUtO***,
Code ***0*** blinks.

Turn ⊛ → ***MAN***

Press ⊛ to switchover to ☞ manual mode. The switchover is smooth since the manual mode starts up with the set point last used during automatic mode. The current position is displayed in %.

Adjust the manual reference variable





Turn ⊛ → Code **1**

Press ⊛, Code ***1*** blinks.

Turn ⊛ until sufficient pressure has been built up in the positioner and the control valve moves to the required position.

Note: *The positioner automatically returns to Code **0**, but remains in ☞ manual mode if no settings are made within 120 seconds.*

Switch to ↻ automatic operating mode

Turn ⊛ → Code **0**

Press ⊛, Code ***0*** blinks.

Turn ⊛ → ***AUtO***

Press ⊛. The positioner changes to automatic operating mode

8.2.2 Fail-safe position (SAFE)

If you want to move the valve to fail-safe position determined during start-up (see section 7.1), proceed as follows:

Turn ↻ → Code **0**

Press ⊛, display: current operating mode (***AUtO*** or ***MAN***), Code ***0*** blinks.

Turn ⊛ → ***SAFE***

Press ⊛, display: ***S***.
The valve moves to the fail-safe position. Once the positioner is initialized, the current valve position is indicated on the display in %.

Exit the fail-safe position

Turn ⊛ → Code ***0***

Press ⊛, Code ***0*** blinks.

Turn ⊛ and select the required operating mode ***AUtO*** or ***MAN***.

Press ⊛. The positioner switches to the operating mode selected.

8.3 Malfunction/maintenance alarm

All status and fault alarms are classified according to a status in the positioner. The default settings of the status classification are listed in the code list.

Note: *The status classification can be changed in TROVIS-VIEW. Refer to EB 8389 EN on EXPERTplus valve diagnostics.*

To provide a better overview, the classified alarms are summarized in a condensed state according to NAMUR Recommendation NE 107 for the positioner. The following status alarms are available:

- **Maintenance alarm**
  The positioner cannot perform its control task due to a functional fault in the device or in one of its peripherals or an initialization has not yet been successfully completed.
- **Maintenance required**
  The positioner still performs its control task (with restrictions). A maintenance requirement or above average wear has been determined. The wear tolerance will soon be exhausted or is reducing at a faster rate than expected. Maintenance is necessary in the medium term.
- **Maintenance demanded**
  The positioner still performs its control task (with restrictions). A maintenance demand or above average wear has been determined. The wear tolerance will soon be exhausted or is reducing at a

faster rate than expected. Maintenance is necessary in the short term.

- **Out of specification**
  The positioner is operated outside specified operating conditions.

Note: *If an event is assigned to the "No message" status, this event does not have any effect on the condensed state.*

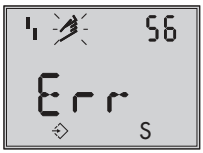
The condensed state appears on the display with the following icons:

Condensed state	Positioner display
Maintenance alarm	
Function check	Text, e.g. ***tESting***, ***TunE*** or ***tESt***
Maintenance required/ Maintenance demanded	
Out of specification	blinking

If the positioner has not been initialized, the maintenance alarm icon ( ) appears on the display as the positioner cannot follow its reference variable.

If fault alarms exist, the possible source of error is displayed in Code **49** onwards. In this case, ***Err*** appears on the display.

The cause and recommended action are listed in the code list (section 14).



Example
Error caused by pin position

Fault alarm output

The "Maintenance alarm" as the condensed state causes the optional fault alarm output to be switched.

- The "Function check" condensed state can also switch the fault alarm contact in Code ***32***.
- The "Maintenance required/demanded" condensed state can also switch the fault alarm contact in Code ***33***.

8.3.1 Confirming error messages

Enable configuration:

Note: *If no settings are entered within 120 seconds, the enabled configuration function becomes invalid.*

Turn ⊛ → Code ***3***

Press ⊛, Code ***3*** blinks

Turn ⊛ → ***ON***

Press ⊛, display: ⇨

Confirm error messages:

Turn ⊛ → Error code which you want to confirm.

Press ⊛ to confirm the error message.

9 Adjusting the limit switch

The positioner version with inductive limit switch has one adjustable tag (1) mounted on the shaft which operates the proximity switch (3).

For operation of the inductive limit switch, the corresponding switching amplifier (see section 5.2.1) must be connected to the output.

If the tag (1) is inside the field of the switch, the switch assumes a high resistance. If the tag is outside of the field, the switch assumes a low resistance.

Normally, the limit switch is adjusted such that it will provide a signal in both end positions of the valve. The switch, however, can also be adjusted to indicate intermediate valve positions.

The desired switching function, i.e. whether the output relay shall be picked up or released when the tag has entered the field, has to be determined, if necessary, at the switching amplifier.

Note:
The inductive limit switch replaces the software limit switch A1 with terminal assignment +41/–42.
Each switching position can optionally be set to indicate when the tag has entered the field, or when it has left the field.
The second software limit switch remains effective, the function of the software limit switch A1 is disabled.

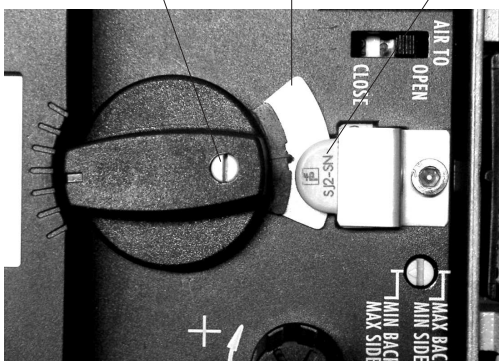


Fig. 26 · Adjustment of the limit switch

Software adaptation

Code ***38*** (inductive alarm is set to ***YES***).
The inductive limit switch is connected to the terminals +41/–42.
The device is set up accordingly when delivered ex works SAMSON.

Setting the switching point:

NOTICE
During adjustment or testing, the switching point must always be approached from mid-position (50 %).

To ensure safe switching under any ambient conditions, the switching point should be adjusted to a value of approx. 5 % before the mechanical stop (OPEN – CLOSED).

For CLOSED position:

1. Initialize positioner.
2. Use the ***MAN*** function to move the positioner to 5 % (see LC display).
3. Adjust the tag using the yellow adjustment screw (2) until the tag enters or leaves the field and the switching amplifier responds. You can measure the switching voltage as an indicator.

Contact function:

- Tag leaving the field > contact is made
- Tag entering the field > contact is opened.

For OPEN position:

1. Initialize positioner.
2. Use the ***MAN*** function to move the positioner to 95 % (see LC display).
3. Adjust the tag (1) using the yellow adjustment screw (2) until the tag enters or leaves the field of the proximity switch (3).
   You can measure the switching voltage as an indicator.

Contact function:

- Tag leaving the field > Contact is made.
- Tag entering the field > Contact is opened.

9.1 Retrofitting an inductive limit switch

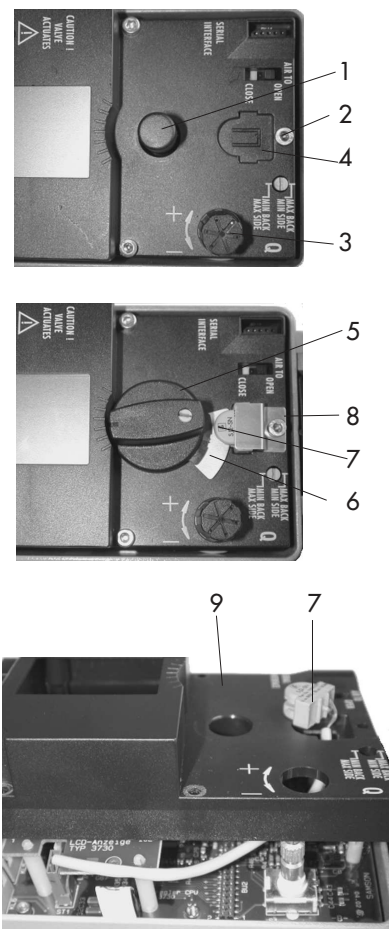
Required retrofit kit:
Limit switch Order no. 1400-7460

Note: *The same requirements apply to retrofitting an inductive limit switch as to servicing the positioner. For explosion-protected devices, the requirements in section 11 need to be kept.*
Check the "Limit switch, inductive" box on the nameplate after retrofitting the limit switch.

---

1. Take off the rotary pushbutton (3) and cap (1), unthread the five fixing screws (2) and lift off the plastic cover (9) together with the display, **taking care not to damage the ribbon cable (between PCB and display)**.

2. Use a knife to cut an opening at the marked location (4).
3. Push the connector (11) with cable through the opening and secure the proximity switch (7) on the cover with a dot of glue.
4. Remove the jumper (8801-2267) at the socket X7 of the top board and insert the cable connector (11).
5. Guide the cable in such a manner that the plastic cover can be placed back onto the positioner. Insert the fixing screws (2) and screw tight. Attach the clamping plate (8) onto the proximity switch.
6. Attach the rotary switch (5). Make sure the flattened side of the positioner shaft is turned so that the rotary switch (5) can be attached with the metal tag next to the proximity switch.
7. **Note:** On start-up of the positioner, set the option "inductive alarm" under Code ***38*** from ***No*** to ***YES***.



1	Cap	6	Metal tag
2	Screws	7	Proximity switch
3	Rotary pushbutton	8	Clamping plate
4	Marking	9	Plastic cover
5	Rotary switch	11	Connector

Fig. 27 · Retrofitting an inductive limit switch

10 Maintenance

The positioner does not require any maintenance.

There are filters with a 100 µm mesh size in the pneumatic connections for supply and output which can be removed and cleaned, if required.

The maintenance instructions of any upstream supply air pressure reducing stations must be observed.

11 Servicing explosion-protected devices

If a part of the device on which the explosion protection is based needs to be serviced, the device must not be put back into operation until a qualified inspector has assessed it according to explosion protection requirements, has issued an inspection certificate or given the device a mark of conformity.

Inspection by a qualified inspector is not required if the manufacturer performs a routine test on the device prior to putting it back into operation. The passing of the routine test must be documented by attaching a mark of conformity to the device. Replace explosion-protected components only by original, routine-tested components from the manufacturer.

Devices that have already been operated outside hazardous areas and are intended for future use inside hazardous areas must comply with the safety requirements placed on serviced devices. Before being used inside hazardous areas, test the devices according to the specifications for servicing explosion-protected devices.

12 Firmware update (serial interface)

Firmware updates on positioners currently in operation can be performed as follows:

When updates are performed by a service employee appointed by SAMSON, the update is confirmed on the positioner by the test mark assigned by SAMSON's Quality Assurance.

In all other cases, only persons from the plant operator with written approval may perform updates. This person must confirm the update on the positioner.

Laptops and PCs connected to the power supply must use an additional safety barrier.

This does not apply to laptops in battery operation. In this case, it is assumed that a battery-powered laptop runs briefly for software programming or for testing purposes.

a) **Updates outside the hazardous area:**

   Remove the positioners from the plant and update them outside the hazardous area.

b) Updates on site:

Updates on site are only permitted after the plant operator has presented a signed hot work permit.

After updating has been completed, add the current firmware to the nameplate; this can be done using labels.

13 Maintenance, calibration and work on equipment

The interconnection with intrinsically safe circuits to check or calibrate the apparatus must only be performed with intrinsically safe current/voltage calibrators and measuring instruments to rule out any damage to components relevant for explosion protection.

The maximum values for intrinsically safe circuits specified in the approvals must be kept.

14 Code list

Code no.	**Parameter** – Readings, values [default setting]	Description
Note: Codes with marked with an asterisk (*) must be enabled with Code **3** prior to configuration.		
0	**Operating mode** [MAN] Manual mode AUtO Automatic mode SAFE Fail-safe position ESC Escape	Switchover from automatic to manual mode is smooth. In fail-safe mode, **S** appears on the display. In MAN and AUtO mode, the system deviation is represented by the bar graph elements. When the positioner is initialized, the numerical display indicates the valve position or the angle of rotation in %, otherwise the position of the lever in relation to the central axis is displayed in degrees °.
1	**Manual w** 0 to 100 [0] % of the nominal range	Adjust the manual set point with the rotary pushbutton, the current travel/angle is displayed in % when the positioner is initialized, otherwise the position of the lever in relation to the central axis is indicated in degrees °. ***Note:*** *Can only be selected when Code **0** = MAN*
2	**Reading direction** [Normal] or upside down ESC	The reading direction of the display is turned by 180°.
3	**Enable configuration** [No] YES ESC	Enables the option to modify data (automatically deactivated when the rotary pushbutton has not been operated for 120 s).

<table>
<tr><th>Code no.</th><th>Parameter – Readings, values [default setting]</th><th>Description</th></tr>
<tr><td colspan="3">Note: Codes with marked with an asterisk (*) must be enabled with Code 3 prior to configuration.</td></tr>
<tr><td>4*</td><td>Pin position
[No]
17, 25, 35, 50, 70, 100, 200, 300 mm
90° with rotary actuators
ESC

Note: If you select a pin position in Code 4 that is too small, the positioner switches to SAFE mode for reasons of safety</td><td>The follower pin must be inserted into the correct pin position according to the valve travel/angle of rotation.
For initialization using NOM or SUb, this pin position must be entered.
<table>
<tr><th>Pin position
Code 4</th><th>Standard
Code 5</th><th>Adjustment range
Code 5</th></tr>
<tr><td>17</td><td>7.5</td><td>3.6 to 17.7</td></tr>
<tr><td>25</td><td>7.5</td><td>5.0 to 25.0</td></tr>
<tr><td>35</td><td>15.0</td><td>7.0 to 35.4</td></tr>
<tr><td>50</td><td>30.0</td><td>10.0 to 50.0</td></tr>
<tr><td>70</td><td>40.0</td><td>14.0 to 70.7</td></tr>
<tr><td>100</td><td>60.0</td><td>20.0 to 100.0</td></tr>
<tr><td>200</td><td>120.0</td><td>40.0 to 200.0</td></tr>
<tr><td>90°</td><td>90.0</td><td>24.0 to 100.0</td></tr>
</table></td></tr>
<tr><td>5*</td><td>Nominal range
[15.0] mm or angle °
ESC</td><td>For initialization using NOM or SUb, the nominal travel/angle of rotation of the valve must be entered.
The permissible adjustment range depends on the pin position according to the table for Code 4.
After initialization has been successfully completed, the maximum nominal travel/angle reached on initialization is displayed.</td></tr>
<tr><td>6*</td><td>Init mode
[MAX]
NOM
MAN
SUb
ZP
ESC</td><td>Select the initialization mode
MAX: Travel/angle of the closure member from the CLOSED position to the opposite stop in the actuator.
NOM: Travel/angle of the closure member measured from the CLOSED position to the indicated OPEN position.
MAN: Manually selected range
SUb: Substitute calibration (without initialization)
ZP: Zero calibration</td></tr>
</table>

Code no.	**Parameter** – Readings, values [default setting]	Description
Note: Codes with marked with an asterisk (*) must be enabled with Code **3** prior to configuration.		
7*	**w/x** [↗↗] increasing/increasing ↗↘ increasing/decreasing ESC	Direction of action of the reference variable w in relation to the travel/angle of rotation x Automatic adaptation: AIR TO OPEN: On completing initialization, the direction of action remains increasing/increasing (↗↗), a globe valve opens as the mA signal increases. AIR TO CLOSE: On completing initialization, the direction of action changes to increasing/decreasing (↗↘), a globe valve closes as the mA signal increases.
8*	**Travel/angle range start (lower x-range value)** 0.0 to 80.0 [0.0] % of the nominal range ESC **Note:** Specified in mm or angle ° provided Code **4** is set	Lower range value for the travel/angle of rotation in the nominal or operating range. The **operating range** is the actual travel/angle of the control valve and is limited by the lower x-range value (Code **8**) and the upper x-range value (Code **9**). Usually, the operating range and the nominal range are identical. The nominal range can be limited to the operating range by the lower and upper x-range values. Value is displayed or must be entered. The characteristic is adapted. See also the example in Code **9**!
9*	**Travel/angle range end (upper x-range value)** 20.0 to 100.0 [100.0] % of the nominal range ESC **Note:** Specified in mm or angle ° provided Code **4** is set	Upper range value for the travel/angle of rotation in the nominal or operating range. Value is displayed or must be entered. The characteristic is adapted. **Example:** The operating range is modified, for example, to limit the range of a control valve which has been sized too large. For this function, the entire resolution range of the reference variable is converted to the new limits. 0 % on the display corresponds to the adjusted lower limit and 100 % to the adjusted upper limit.
10*	**Travel/angle lower limit (lower x-limit)** 0.0 to 49.9 % of the operating range [No], ESC	Limitation of the travel/angle of rotation downwards to the entered value, the characteristic is not adapted. The characteristic is not adapted to the reduced range. See also example in Code **11**.

Code no.	**Parameter** – Readings, values [default setting]	Description
Note: Codes with marked with an asterisk (*) must be enabled with Code **3** prior to configuration.		
11*	**Travel/angle upper limit (upper x-limit)** 50.0 to 120.0 [100] % of the operating range No, ESC	Limitation of the travel/angle of rotation upwards to the entered value, the characteristic is not adapted. **Example:** In some applications, it is better to limit the valve travel, e.g. if a certain minimum medium flow is required or a maximum flow must not be reached. The lower limit must be adjusted with Code **10**, and the upper limit with Code **11**. If a tight-closing function has been set up, it has priority over the travel limitation! When set to No, the valve can be opened past the nominal travel with a reference variable outside of the 0 to 100 % range.
12*	**w-start** 0.0 to 75.0 [0.0] % of the reference variable range ESC	Lower range value of the applicable reference variable range must be smaller than the final value w-end, 0 % = 4 mA The reference variable range is the difference between w-end and w-start, and must be $\Delta w \geq 25$ % = 4 mA. For an adjusted reference variable range of 0 to 100 % = 4 to 20 mA, the control valve must move through its entire operating range from 0 to 100 % travel/angle of rotation. In **split-range operation**, the valves operate with smaller reference variables. The control signal of the control unit to control two valves is divided such, for instance, that the valves move through their full travel/angle of rotation at only half the input signal (first valve set to 0 to 50 % = 4 to 12 mA and second valve set to 50 to 100 % =12 to 20 mA reference variable).
13*	**w-end** 25.0 to 100.0 [100.0] % of the reference variable range ESC	Upper range value of the applicable reference variable range, must be greater than w-start. 100 % = 20 mA
14*	**Reference variable range start** (w-start) 0.0 to 49.9 [1.0] % of the span adjusted via Code **12/13** No, ESC	If w approaches the percentage adjusted at the final value that causes the valve to close, the actuator is immediately completely vented (with AIR TO OPEN) or filled with air (with AIR TO CLOSE). This action always lead to maximum tight-closing of the valve. Codes **14/15** have priority over Codes **8/9/10/11**. Codes **21/22** have priority over Codes **14/15**.

Code no.	**Parameter** – Readings, values [default setting]	Description
Note: Codes with marked with an asterisk (*) must be enabled with Code **3** prior to configuration.		
15*	**Reference variable range end** (w-end) 50.0 to 100.0 % of the span adjusted via Code **12/13** [No], ESC	If w approaches the percentage adjusted at the final value that causes the valve to open, the actuator is immediately completely filled with air (with AIR TO OPEN) or vented (with AIR TO CLOSE). This action always lead to the valve being completely opened. Codes **14/15** have priority over Codes **8/9/10/11**. Codes **21/22** have priority over Codes **14/15**. **Example:** Set the final position w > to 99 % for three-way valves.
16*	**Pressure limit** [No] 1.4 2.4 3.7 bar ESC	The signal pressure to the actuator can be limited in stages. After changing a pressure limit already set, the actuator must be vented once (e.g. by selecting the fail-safe position (SAFE) over Code **0**). ***NOTICE*** *Do not activate the pressure limit for double-acting actuators with valve closed position AIR TO OPEN (AtO).*
17*	**Proportional-action coefficient KP (step)** 0 to 17 [7] ESC	Displaying or changing K_P **Note on changing the K_P and T_V steps:** During the initialization of the positioner, the K_P and T_V values are optimized. Should the positioner show a tendency for impermissibly high post-pulse oscillation due to additional interference, the K_P and T_V steps can be adapted after the initialization. For this, either the T_V step can be increased in increments until the desired response behavior is reached or, when the maximum value of 4 is reached, the K_P step can be decreased in increments. ***NOTICE*** *Changing the K_P step influences the system deviation.*
18*	**Rate time TV (step)** 1 [2] 3 4 No ESC	Displaying or changing T_V, see note under K_P step A change of the T_V step has no effect on the system deviation.

Code no.	**Parameter** – Readings, values [default setting]	Description
Note: Codes with marked with an asterisk (*) must be enabled with Code **3** prior to configuration.		
19*	**Tolerance band** 0.1 to 10.0 [5.0] % of the operating range ESC	Used for error monitoring Determination of the tolerance band in relation to the operating range. Associated lag time [30] s is a reset criterion. If a transit time is determined during initialization which is six times > 30 s, the six-fold transit time is accepted as the lag time.
20*	**Characteristic** 0 to 9 [0] ESC	Select the characteristic: 0 Linear 1 Equal percentage 2 Reverse equal percentage 3 SAMSON butterfly valve linear 4 SAMSON butterfly valve equal percentage 5 VETEC rotary plug valve linear 6 VETEC rotary plug valve equal percentage 7 Segmented ball valve linear 8 Segmented ball valve equal percentage 9 User-defined (defined over operating software) ***Note:*** *The various characteristics are listed in the Appendix (section 16).*
21*	**Required transit time OPEN (w ramp open)** 0 to 240 s [0] ESC	The time required to pass through the operating range when the valve opens. Limitation of the transit time (Code **21** and **22**): For some applications it is recommendable to limit the transit time of the actuator to prevent it from engaging too fast in the running process. Code **21** has priority over Code **15**. ***NOTICE*** *The function is not activated when the fail-safe function or solenoid valve is triggered nor upon failure of the auxiliary power.*
22*	**Required transit time CLOSED (w ramp closed)** [0] to 240 s ESC	The time required to pass through the operating range when the valve closes. Code **22** has priority over Code **14**. ***NOTICE*** *The function is not activated when the fail-safe function or solenoid valve is triggered nor upon failure of the auxiliary power.*

Code no.	**Parameter** – Readings, values [default setting]	Description
Note: Codes with marked with an asterisk (*) must be enabled with Code **3** prior to configuration.		
23*	**Total valve travel** 0 to 99 · 10^7 [0] Exponential reading from 9999 travel cycles onwards RES, ESC	Totaled double valve travel. Can be reset to 0 over Code **36 - Std**. ***Note:*** The total valve travel is saved in a non-volatile memory after every 1000 double travel.
24*	**LV total valve travel** 1000 to 99 · 10^7 [1 000 000] Exponential reading from 9999 travel cycles onwards ESC	Limit value of total valve travel. If the limit is exceeded, and icons appear on the display.
25*	**Alarm mode** 0 to 3 [2] ESC	Switching mode of software limit switches alarm A1 and A2 in responding state (when positioner has been initialized). 1) Explosion-protected version according to EN 60947-5-6 0: A1 ≥ 2.2 mA A2 ≤ 1.0 mA 1: A1 ≤ 1.0 mA A2 ≤ 1.0 mA 2: A1 ≥ 2.2 mA A2 ≥ 2.2 mA 3: A1 ≤ 1.0 mA A2 ≥ 2.2 mA 2) Version without explosion protection 0: A1 R = 348 Ω A2 Non-conducting 1: A1 Non-conducting A2 Non-conducting 2: A1 R = 348 Ω A2 R = 348 Ω 3: A1 Non-conducting A2 R = 348 Ω When a positioner has not been initialized, the software limit switches always register the signal as in the state of no response. If there is no mA signal at the terminals 11/12, the software limit switches both switch to ≤ 1.0 mA signal (Ex) or non-conducting (without explosion protection). ***Note:*** *The fault alarm output always switches to ≤ 1.0 mA/ non-conducting in case of fault arises; it has ≥ 2.2 mA/R = 348 Ω when there is no fault.*

Code no.	**Parameter** – Readings, values [default setting]	Description
Note: Codes with marked with an asterisk (*) must be enabled with Code **3** prior to configuration.		
26*	**Limit value A1** No 0.0 to 100.0 [2.0] % of the operating range ESC	Alarm A1 goes into the state of response when the value exceeds the limit. Displaying or changing the software limit value A1 in relation to the operating range. Setting has no effect when an inductive limit switch has been installed.
27*	**Limit value A2** No 0.0 to 100.0 [98.0] % of the operating range ESC	Alarm A2 goes into the state of response when the value falls below the limit. Displaying or changing the software limit value A2 in relation to the operating range.
28*	**Alarm test** Reading direction: Standard [No] RUN 1 RUN 2 RUN 3 ESC Turned [No] 1 RUN 2 RUN 3 RUN ESC	Testing the software limit switches alarm A1 and A2 in addition to the fault alarm contact A3. If the test is activated, the respective limit switches five times. RUN1/1 RUN: Software limit switch A1 to ≥ 2.2 mA RUN2/2 RUN: Software limit switch A2 to ≥ 2.2 mA RUN3/3 RUN: Fault alarm contact A3 to ≤ 1.0 mA
29*	**Position transmitter x/ix** [3)] [↗↗] ↗↘ ESC	Operating direction of the position transmitter; indicates how the travel/angle position is assigned to the output signal i, based on the closed position. The operating range (see Code **8**) of the valve is represented by the 4 to 20 mA signal. Values exceeding or falling below the limits 2.4 to 21.6 mA can be represented. When a positioner has not been initialized (reference variable less than 3.6 mA), the power consumption of the feedback signal is effective (current approx. 1.8 mA). When *YES* is set in Code **32**, the position transmitter issues the value as per Code **30** during initialization or zero calibration. When *No* is set in Code **32**, 4 mA is issued during a running self-adaptation.

Code no.	**Parameter** – Readings, values [default setting]	Description
Note: Codes with marked with an asterisk (*) must be enabled with Code **3** prior to configuration.		
30*	**Fault alarm ix** [3] [No] HI LO ESC	Used to select whether faults causing the fault alarm contact to switch should also be signaled by the position transmitter output and how they should be signaled HI ix = 21.6 ±0.1mA or LO ix = 2.4 ±0.1mA
31*	**Position transmitter test** [3] –10.0 to 110.0 [default value is last indicated value of the position transmitter] % of the operating range ESC	Testing the position transmitter. Values can be entered in relation to the operating range. The current actual value is used in initialized positioners locally as the start value (bumpless changeover to the test mode). On testing over software, the entered simulation value is issued as the position feedback signal for 30 seconds.
	[3]Analog position transmitter: Code 29/30/31 can only be selected if the position transmitter (optional) is installed.	
32*	**Fault alarm with "Function check" condensed state** [YES] · No ESC	YES: Fault alarm also with "Function check" condensed state No: "Function check" condensed state does not cause a fault alarm to be issued ***Note:*** *Regardless of the condensed state, the fault alarm output always switches when error codes 57, 58, 60, 62 and 64 to 70, 76 are issued.*
33*	**Fault alarm with "Maintenance required" condensed state** [YES] · No ESC	YES: Fault alarm only with "Maintenance alarm" condensed state and with "Maintenance required" condensed state No: Fault alarm only with "Maintenance alarm" condensed state ***Note:*** *Regardless of the condensed state, the fault alarm output always switches when error codes 57, 58, 60, 62 and 64 to 70, 76 are issued.*
34*	**Closing direction** CL [CCL] ESC	CL: Clockwise, CCL: Counterclockwise Turning direction in which the valve is moved to the CLOSED position (view onto the rotary switch motion when the positioner cover is open). ***Note:*** *Needs only be entered in initialization mode SUb (Code **6**).*
35*	**Blocking position** [0] mm/° /% ESC	Entering the blocking position. Distance up to the CLOSED position. ***Note:*** *Only necessary in initialization mode SUb.*

Code no.	**Parameter** – Readings, values [default setting]	**Description**
Note: Codes with marked with an asterisk (*) must be enabled with Code **3** prior to configuration.		
36*	**Reset** [No] Std · diAG ESC	Std: Resets all parameters to default (factory setting) as well as the diagnosis data. After a reset, the positioner must be re-initialized. diAG: Resets diagnosis data only. Plotted reference graphs and logs remain unaffected. The positioner does not need to be re-initialized.
37	**Position transmitter** No · YES	Display only, indicates whether the position transmitter option is installed.
38*	**Inductive alarm** [No], YES, ESC	Indicates whether the inductive limit switch option is installed or not.
39	**System deviation e info** –99.9 to 999.9 %	Display only, indicates the deviation from the target position (e = w – x).
40	**Transit time Open info** 0 to 240 s [0]	Display only, minimum opening time determined during initialization.
41	**Transit time Closed info** 0 to 240 s [0]	Display only, minimum closing time determined during initialization.
42	**Auto-w/manual-w info** 0.0 to 100.0 % of the span 4 to 20 mA	Display only, Supplied automatic reference variable according to 4 to 20 mA
43	**Firmware info** Xxxx	Display only, indicates the positioner type and current firmware version in alternating sequence.
44	**y info** [0] to 100 % 0 P, MAX, – – –	Display only. Indicates the control signal y in % based on the travel range determined on initialization MAX: The positioner builds up its maximum output pressure, see description in Code **14** and **15**. 0 P: The positioner vents completely, see description in Code **14** and **15**. – – –: The positioner is not initialized.

Code no.	**Parameter** – Readings, values [default setting]	Description
Note: Codes with marked with an asterisk (*) must be enabled with Code **3** prior to configuration.		
45	**Solenoid valve info** YES HIGH/LOW No	Display only, indicates whether a solenoid valve is installed or not. If a voltage supply is connected at the terminals of the installed solenoid valve, *YES* and *HIGH* appear on the display in alternating sequence. If a voltage supply is not connected (actuator vented, fail-safe position indicated on the display by the **S** icon), *YES* and *LOW* appear on the display in alternating sequence.
48* **49***	**Diagnostics** (refer to EB 8389 EN on EXPERTplus valve diagnostics)	

Note: *The error codes listed in following appear in the display corresponding to their status classification set over the condensed state (Maintenance required/Maintenance demanded: 🔧, Out of specification: 🔧 blinking, Maintenance alarm: !). If "No message" is assigned to the error code as the status classification, the error is not included in the condensed state. A status classification is assigned to every error code in the default setting. The status classification of error codes can also be changed as required using an operating software (e.g. TROVIS-VIEW).*

Initialization errors

Error codes – Recommended action		Condensed state alarm active, when prompted, ***Err*** appears. When error messages exist, they are displayed here.
50	**x > range**	The value supplied by the measuring signal is either too high or too low, the measuring sensor is close to its mechanical limit. • Pin positioned incorrectly. • Bracket slipped in case of NAMUR attachment or positioner is not central. • Follower plate incorrectly attached.
	Status classification	[Maintenance required]
	Recommended action	Check attachment and pin position, set operating mode from SAFE to MAN and re-initialize the positioner.
51	**∆x < range**	The measuring span of the sensor is too low. • Pin positioned incorrectly. • Wrong lever. A rotational angle smaller than 16° at the positioner shaft only generates a message. An angle below 9° leads to the initialization being canceled.
	Status classification	[Maintenance required]
	Recommended action	Check attachment and re-initialize the positioner.
52	**Attachment**	• Positioner attachment incorrect. • Nominal travel/angle (Code **5**) could not be reached during initialization under NOM (no tolerance downwards permissible). • Mechanical or pneumatic fault, e.g. wrong lever selected or supply pressure too low to move to the required position.
	Status classification	[Maintenance required]
	Recommended action	Check attachment and supply pressure. Re-initialize the positioner. Under certain circumstances, it may be possible to check the maximum travel/angle by entering the actual pin position and then performing an initialization under MAX. After initialization has been completed, the Code **5** indicates the maximum achieved travel or angle.

Error codes – Recommended action		Condensed state alarm active, when prompted, ***Err*** appears. When error messages exist, they are displayed here.
53	**Initialization time exceeded (Init time >)**	The initialization routine lasts too long. • No pressure on the supply line or there is a leak. • Supply air failure during initialization.
	Status classification	[Maintenance required]
	Recommended action	Check attachment and supply pressure. Re-initialize the positioner.
54	**Initialization - solenoid valve**	1) A solenoid valve is installed (Code **45** = YES) and was not or not properly connected so that an actuator pressure could not be built up. The message is generated when you attempt to initialize the positioner. 2) If you attempt to initialize the device from the fail-safe position (SAFE).
	Status classification	[Maintenance required]
	Recommended action	Re. 1) Check connection and supply voltage of the forced venting Code **45** HIGH/LOW Re. 2) Set the ***MAN*** operating mode over Code **0**. Then initialize the positioner.
55	**Transit time too short (transit time <)**	The actuator positioning rates determined during the initialization are so short that the positioner cannot adapt itself optimally.
	Status classification	[Maintenance required]
	Recommended action	Check the volume restriction setting as described in section 7.2, re-initialize the positioner.
56	**Pin position**	Initialization was canceled because you are required to enter the pin position for the selected initialization modes ***NOM*** and ***SUb***.
	Status classification	[Maintenance required]
	Recommended action	Enter pin position over Code **4** and nominal travel/angle over Code **5**. Re-initialize the positioner.

Operational errors

Error codes – Recommended action		Condensed state alarm active, when prompted, ***Err*** appears. When error messages exist, they are displayed here.
57	**Control loop**	Control loop error, the control valve does not react within the tolerable times of the controlled variable (tolerance band alarm Code **19**). • Actuator mechanically blocked. • Attachment of the positioner subsequently shifted. • Supply pressure not sufficient.
	Status classification	[Maintenance required]
	Recommended action	Check attachment.
58	**Zero point**	Zero point incorrect. Error may arise when the mounting position/linkage of the positioner moves or when the valve seat trim is worn, especially with soft-sealed plugs.
	Status classification	[Maintenance required]
	Recommended action	Check valve and mounting of the positioner. If OK, perform a zero calibration over Code **6** (see section 7.7 on page 70). We recommend re-initializing the positioner when zero point deviations over 5 % occur.
59	**Autocorrection**	Should an error occur in the data range of the positioner, the self-monitoring function recognizes it and automatically corrects it.
	Status classification	[No message]
	Recommended action	Automatic
60	**Fatal error**	An error was detected in the data relevant for safety, autocorrection is not possible. This may be due to EMC disturbances. The positioner changes to the fail-safe position (SAFE).
	Status classification	Maintenance alarm (cannot be classified)
	Recommended action	Reset over Code **36 - Std**. Re-initialize the positioner.

Hardware errors

Error codes – Recommended action		Condensed state alarm active, when prompted, ***Err*** appears. When error messages exist, they are displayed here.
62	**x signal**	Determination of the measured data for the actuator has failed. Conductive plastic element is defective. The positioner continues to run in emergency mode, but should be replaced as soon as possible. The emergency mode on the display is indicated by a blinking closed-loop operation icon and 4 dashes instead of the position indication. **Note on the closed-loop operation:** If the measuring system has failed, the positioner is still in a reliable state. The positioner switches to emergency mode where the position cannot be accurately controlled anymore. However, the positioner continues to operate according to its reference variable signal so that the process remains in a safe state.
	Status classification	[Maintenance demanded]
	Recommended action	Return the positioner to SAMSON AG for repair.
63	**w too small**	The reference variable is much smaller than 4 mA (0 %); occurs if the power source that drives the positioner does not comply with the standard. This state is indicated on the positioner display by a blinking ***LOW***.
	Recommended action	[No message]
	Remedy	Check reference variable. If necessary, limit the current source downwards so that no values below 4 mA can be issued.
64	**i/p converter**	The circuit of the i/p converter has been interrupted.
	Status classification	Maintenance alarm (cannot be classified)
	Recommended action	Cannot be remedied. Return the positioner to SAMSON AG for repair.

Error codes – Recommended action		Condensed state alarm active, when prompted, ***Err*** appears. When error messages exist, they are displayed here.
65	**Hardware**	Initialization key jammed (firmware version 1.51 and higher). A hardware error has occurred, the positioner changes to the fail-safe position (SAFE).
	Status classification	[Maintenance alarm]
	Recommended action	Check initialization key. Confirm error and return to the automatic operating mode, or perform a reset and re-initialize the device. If this is not successful, return device to SAMSON AG for repair.
66	**Data memory**	The writing of data to the data memory does not work anymore, e.g. when the written data deviate from the read data. Valve moves to the fail-safe position.
	Status classification	Maintenance alarm (cannot be classified)
	Recommended action	Return the positioner to SAMSON AG for repair.
67	**Test calculation**	The hardware controller is monitored by means of a test calculation.
	Status classification	[Maintenance alarm]
	Recommended action	Confirm error. If this is not possible, return the positioner to SAMSON AG for repair.

Data errors

Error codes – Recommended action		Condensed state alarm active, when prompted, ***Err*** appears. When error message exist, they are displayed here.
68	**Control parameter**	Control parameter error
	Status classification	[Maintenance required]
	Recommended action	Confirm error, perform reset and re-initialize the positioner.
69	**Poti parameter**	Parameter error of the digital potentiometer.
	Status classification	[Maintenance required]
	Recommended action	Confirm error, perform reset and re-initialize the positioner.
70	**Calibration parameter**	Error in the production calibration data. Subsequently, the device runs on default values.
	Status classification	[Maintenance required]
	Recommended action	Return the positioner to SAMSON AG for repair.
71	**General parameters**	Parameter errors that are not critical for the control.
	Status classification	[Maintenance required]
	Recommended action	Confirm error. Check and, if necessary, reset required parameters.
73	**Internal device error 1**	Internal device error
	Status classification	[Maintenance required]
	Recommended action	Return the positioner to SAMSON AG for repair.
75	**Info parameter**	Internal positioner error
	Status classification	[Maintenance required]
	Recommended action	Confirm error. Check and, if necessary, reset required parameters.

Error codes – Recommended action		Condensed state alarm active, when prompted, ***Err*** appears. When error message exist, they are displayed here.
76	**No emergency mode**	The travel measuring system of the positioner has a self-monitoring function (see Code **62**). An emergency mode (open-loop control) is not available for certain actuators, such as double-acting actuators. In this case, the positioner changes to the fail-safe position (SAFE) when a measuring error occurs. During the initialization, the positioner checks whether the actuator has such a function or not.
	Status classification	[No message]
	Recommended action	Merely information, confirm, if necessary. No further action necessary.
77	**Program loading error** Additional alarm at the fault alarm output	When the positioner starts operation for the first time after the input signal has been applied, it carries out a self-test (***tEStinG*** runs across the display). If the positioner loads the wrong program, the valve moves to the fail-safe position. It is not possible to make the valve leave this fail-safe position again.
	Status classification	Maintenance alarm (cannot be classified)
	Recommended action	Interrupt current and restart positioner. Otherwise, return the positioner to SAMSON AG for repair.
78	**Options parameter**	Errors in options parameters
	Status classification	[Maintenance required]
	Recommended action	Return the positioner to SAMSON AG for repair.

Diagnosis errors

Error codes – Recommended action		Condensed state alarm active, when prompted, ***Err*** appears. When error messages exist, they are displayed here.
79	**Extended diagnostics**	Messages are generated by the extended EXPERTplus diagnostics (refer to EB 8389 EN on EXPERTplus valve diagnostics)
	Status classification	Maintenance required (cannot be classified)
80	**Diagnostic parameters**	Errors that are not critical for control.
	Status classification	Maintenance required (cannot be classified)
	Recommended action	Confirm error. Check and, if necessary, perform a new reference test
81	**Reference graphs**	An error occurred during plotting the reference graphs for drive signal y steady-state or drive signal y hysteresis. • Reference test was interrupted • Reference line for drive signal y steady-state or drive signal y hysteresis was not adopted. Error messages are saved in a non-volatile memory. They cannot be reset.
	Status classification	[Maintenance required]
	Recommended action	Check and, if necessary, perform a new reference test

15 Dimensions in mm

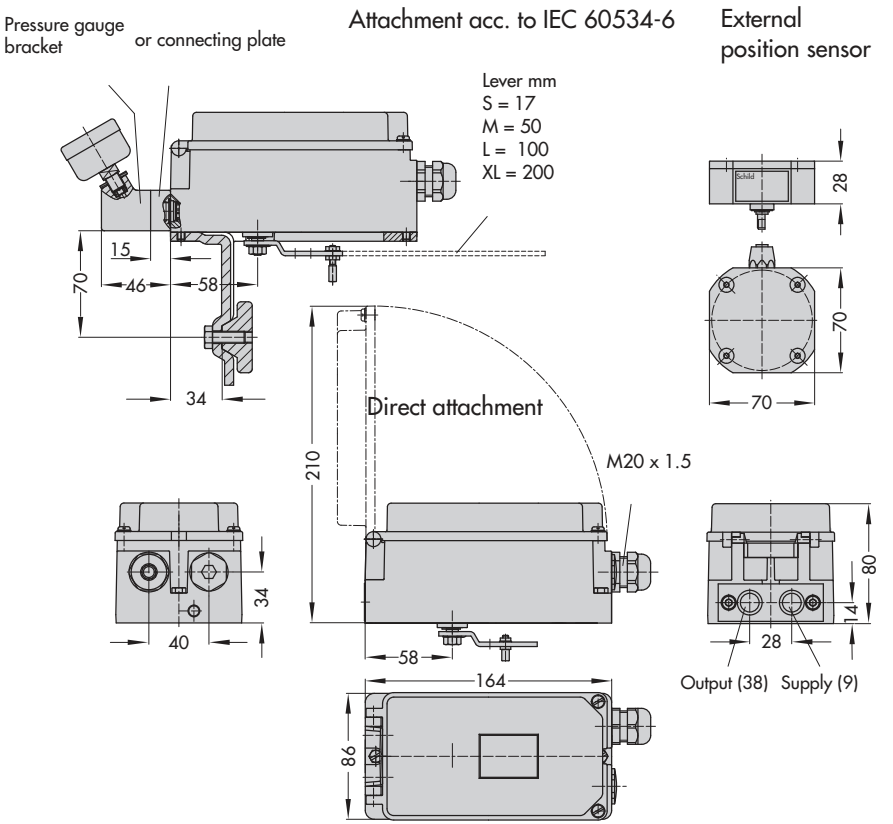
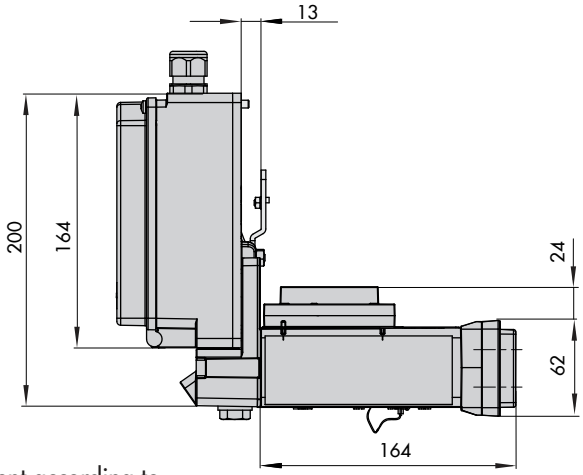


Fig. 28a · NAMUR and direct attachment

Attachment according to VDI/VDE 3847
to Type 3277



Attachment according to
VDI/VDE 3847
on NAMUR rib

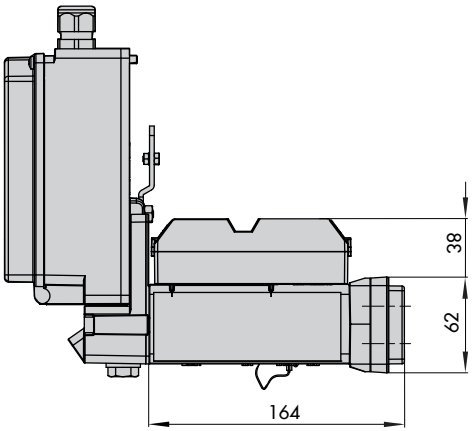
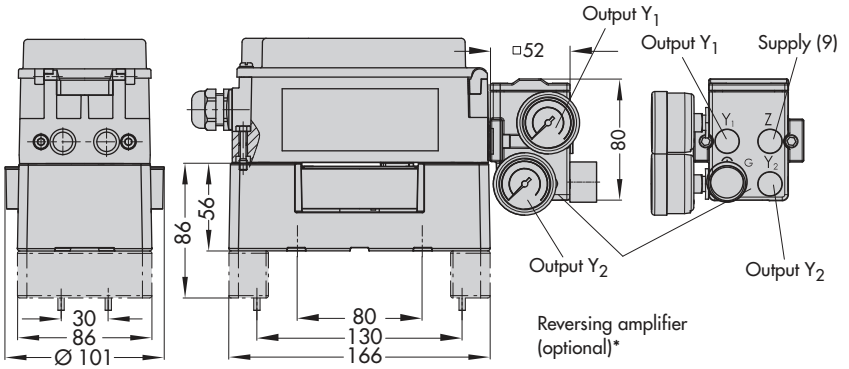
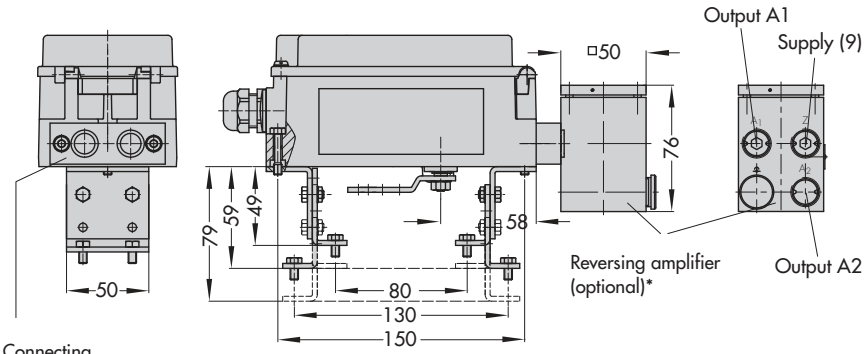


Fig. 28b · Attachment according to VDI/VDE 3847

Heavy-duty version



Light version

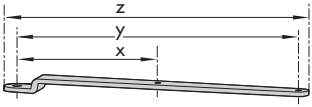


* Reversing amplifier

– Type 3710 (see drawing of heavy-duty version for dimensions)

– 1079-1118/1079-1119, no longer available (see drawing of light version for dimensions)

Fig. 28c · Attachment to rotary actuators VDI/VDE 3845 (Sept. 2010), level 1, size AA1 to AA4



Lever	x	y	z
S	17 mm	25 mm	33 mm
M	25 mm	50 mm	66 mm
L	70 mm	100 mm	116 mm
XL	100 mm	200 mm	216 mm

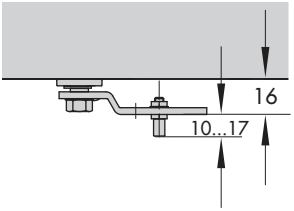
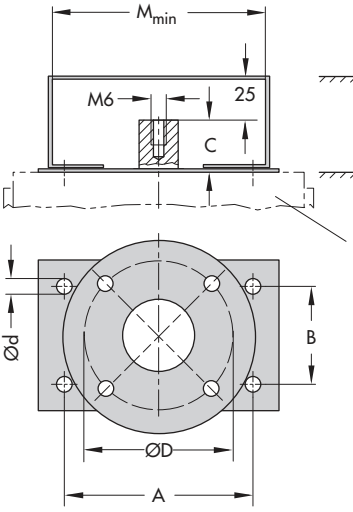


Fig. 29 · Lever

15.1 Fixing levels according to VDI/VDE 3845 (September 2010)



Dimensions in mm

Size	A	B	C	Ød	M_{min}	ØD*
AA0	50	25	15	5.5 for M5	66	50
AA1	80	30	20	5.5 for M5	96	50
AA2	80	30	30	5.5 for M5	96	50
AA3	130	30	30	5.5 for M5	146	50
AA4	130	30	50	5.5 for M5	146	50
AA5	200	50	80	6.5 for M6	220	50

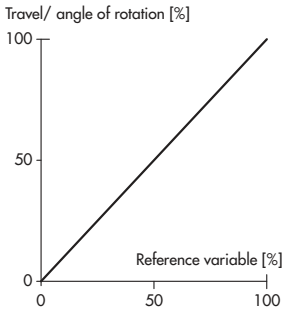
* Flange type F05 according to DIN EN ISO 5211

16 Valve characteristic selection

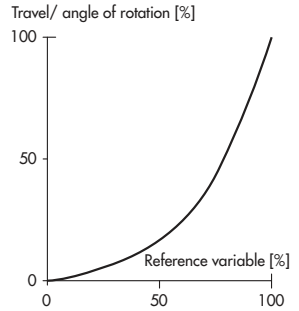
The characteristics that can be selected in Code **20** are shown in following **in graph form**.

Note: *A characteristic can only be defined (user-defined characteristic) using a workstation/ operating software (e.g. TROVIS-VIEW).*

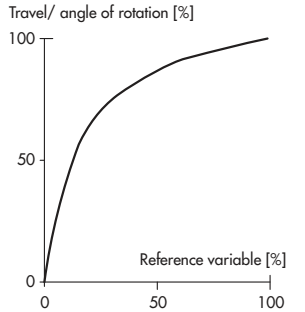
Linear (select characteristic: 0)



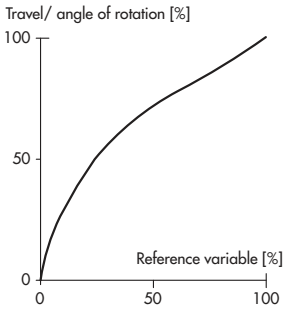
Equal percentage (select characteristic: 1)



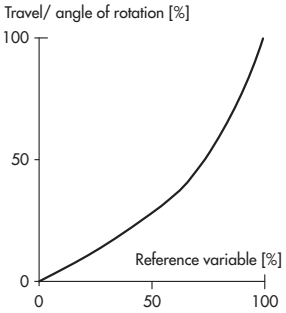
Rev. equal percentage (select characteristic: 2)



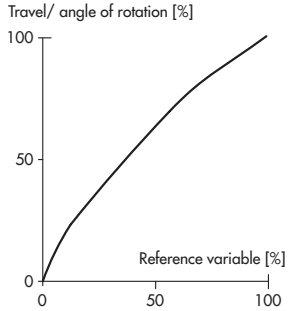
SAMSON butterfly valve linear
(select characteristic: 3)



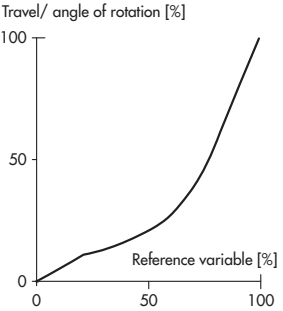
SAMSON butterfly valve equal percentage
(select characteristic: 4)



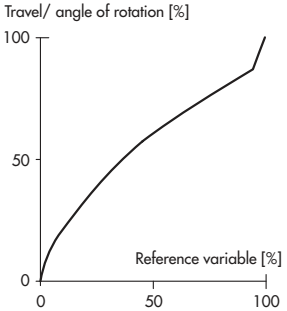
VETEC rotary plug valve linear
(select characteristic: 5)



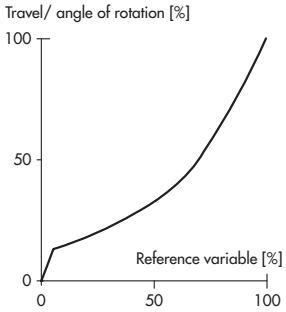
VETEC rotary plug valve equal percentage
(select characteristic: 6)



Segmented valve ball linear
(select characteristic: 7)



Segmented ball valve equal percentage
(select characteristic: 8)



VDE
VDE Prüf und Zertifizierungsinstitut

TRANSLATION

Offenbach, 2005-11-21

Your ref.	Your letter	Our ref.	Contact
P. Opl	2005-11-08	479000-9010-0001/67325 FG33/bhl-wah	H. Biehl Tel. (069) 8306-249 Fax (069) 8306-716 gerhard.biehl@vde.com

Test report for Information of the Applicant

Testing of the Degree of Protection on enclosures of Type 3730 and Type 3731 Positioners

This test report contains the result of a single investigation carried out on the product submitted. A sample of this product was tested to found the accordance with the thereafter listed standards resp. parts of standards.

The test report does not entitle to use a VDE Certification mark and the *"GS = geprüfte Sicherheit (test safety)"* and does not refer to all VDE specifications applicable to the tested product.

This report may only be passed to a third party in its complete wording including this preamble and the date of issue.

Any publication or reproduction requires the prior written approval of the VDE Testing and Certification Institute.

1 Assignment

The samples described in 2 below were tested for compliance with the IP 66 degree of protection.

2 Samples

2.1 Type 3730 Positioner

2.2 Type 3731 Positioner

VDE
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3 Basis of assessment

DIN EN 60529/VDE 0470 Part 1/2000-09
Degree of protection provided by enclosures (IP Code)
German version EN 60529:1999+A1:2000

4 Execution of the tests

The dust test had already been carried out on the Type 3730 Positioner under the reference number: 479000-9010-0001/32752 and on the Type 3731 Positioner under the reference number: 479000-9010-0001/58985 with suction as per category 1 at the connecting enclosures of the positioners and solenoid valves. The under pressure was 2 kPa and the test lasted 8 hours.

5 Test results

The testing of the samples described in 2 above yielded the following results:

Protecting against access to hazardous parts and against ingress of solid foreign objects according to DIN EN 60529/VDE 0470 Part 1:2000-09 **IP6X satisfied**

Protecting against ingress of water according to DIN EN 60529/VDE 0470 Part 1:2000-09 **IPX6 satisfied**

The positioner enclosures in the versions submitted meet the requirements of IP 66 degree of protection.

There was no ingress of either dust or water.

VDE- Prüf- und Zertifizierungsinstitut
Fachgebiet FG33

(Signature) (Signature)

Gerhard Biehl

VDE VERBAND DER ELEKTROTECHNIK
ELEKTRONIK INFORMATIONSTECHNIK e.V

Testing and Certification Institute
Merianstrasse 28
D-63069 Offenbach

Prüfbericht VDE u. EN 60529 IP-Schutzart.doc 2 *e-mail: vde-institut@vde.com*

IECEx Certificate of Conformity

INTERNATIONAL ELECTROTECHNICAL COMMISSION
IEC Certification Scheme for Explosive Atmospheres
for rules and details of the IECEx Scheme visit www.iecex.com

Certificate No.: IECEx PTB 05.0007 Issue No.: 0

Status: Current

Date of Issue: 2005-02-21 Page 1 of 3

Applicant: SAMSON AG Mess- und Regeltechnik
Weismuellerstrasse 3
D-60314 Frankfurt am Main
Germany

Electrical Apparatus: e/p-positioner type 3730-21..
Optional accessory:

Type of Protection: General Requirements, Intrinsic Safety, Protection by Enclosure

Marking: Ex ia IIC T6/T5/T4
IP 54 and IP 65 T 80 °C

Approved for issue on behalf of the IECEx Certification Body: Dr.-Ing. Ulrich Johannsmeyer

Position: Department Head "Intrinsic Safety and Safety of Systems

Signature: (for printed version) _____

Date: _____

1. This certificate and schedule may only be reproduced in full.
2. This certificate is not transferable and remains the property of the issuing body.
3. The Status and authenticity of this certificate may be verified by visiting the Official IECEx Website.

Certificate issued by:

Physikalisch-Technische Bundesanstalt (PTB)
Bundesallee 100
38116 Braunschweig
Germany

IECEx Certificate of Conformity

Certificate No.: IECEx PTB 05.0007

Date of Issue: 2005-02-21 Issue No.: 0

Page 2 of 3

Manufacturer: SAMSON AG Mess- und Regeltechnik
Weismuellerstrasse 3
D-60314 Frankfurt am Main
Germany

Manufacturing location(s):

This certificate is issued as verification that a sample(s), representative of production, was assessed and tested and found to comply with the IEC Standard list below and that the manufacture'rs quality system, relating to the Ex products covered by this certificate, was assessed and found to comply with the IECEx Quality system requirements. This certificate is granted subject to the conditions as set out in IECEx Scheme Rules, IECEx 02 and Operational Documents as amended.

STANDARDS:
The electrical apparatus and any acceptable variations to it specified in the schedule of this certificate and the identified documents, was found to comply with the following standards:

IEC 60079-0 : 2000 Edition: 3.1	Electrical apparatus for explosive gas atmospheres - Part 0: General requirements
IEC 60079-11 : 1999 Edition: 4	Electrical apparatus for explosive gas atmospheres - Part 11: Intrinsic safety 'i'
IEC 61241-1-1 : 1999 Edition: 2	Electrical apparatus for use in the presence of combustible dust - Part 1-1: Electrical apparatus protected by enclosures and surface temperature limitation - Specification for apparatus

*This Certificate **does not** indicate compliance with electrical safety and performance requirements other than those expressly included in the Standards listed above.*

TEST & ASSESSMENT REPORTS:
A sample(s) of the equipment listed has successfully met the examination and test requirements as recorded in

IECEx ATR: DE/PTB/05-004

File Reference: B002158

IECEx Certificate of Conformity

Certificate No.: IECEx PTB 05.0007

Date of Issue: 2005-02-21 Issue No.: 0

Schedule

EQUIPMENT:
Equipment and systems covered by this certificate are as follows:

General description: single- or double-acting positioner for attachment to pneumatic actuators with self-balancing automatic adjustment to valve and actuator. Reference variable: 4 to 20mA, Nominal travels 3.6 to 200 mm; angles of rotation: 24 to 100° Features: Simple attachment to current linear and rotary actuators with interface for SAMSON - direct attachment. NAMUR- rib; attachment to rod-type yoke acc. to IEC 60534-6-1. Any mounting position. Options: Position indicator, software proximity switches, inductive proximity switch, forced venting function, fault alarm output, external displacement transducer and serial interface.

CONDITIONS OF CERTIFICATION: NO

Annexe: 3730-21_Electrical data.pdf; 3730-21_Type code.pdf

Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

PTB

TRANSLATION

(1) **EC TYPE EXAMINATION CERTIFICATION**

(2) Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres – **Directive 94/9/EC**

(3) EC Type Examination Certificate Number

PTB 00 ATEX 2158

(4) Equipment: Model 3730-21... I/P Positioner

(5) Manufacturer: SAMSON AG

(6) Address: Weismüllerstr. 3, D-60314 Frankfurt, Germany

(7) This equipment and any acceptable variation thereof are specified in the schedule to this certificate.

(8) The Physikalisch-Technische Bundesanstalt, certified body number 0102 in according to Article 9 of the Council Directive 94/9/EC of 23 March 1994, certifies that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres given in Annex II to the Directive.

The examination and test results are recorded in confidential report PTB Ex 01-20216.

(9) The Essential Health and Safety Requirements are satisfied by compliance with

EN 50014: 1997 **EN 50020: 1994**

(10) If the sign "X" is placed after the certificate number, it indicates that the equipment is subject to special conditions for safe use specified in the schedule to this certificate.

EC Type Examination Certificates without signature and seal are invalid.
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Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

PTB

Test Report: **PTB Ex 01-20216**

(11) Accroding to the Directive 94/9/EC, this EC TYPE EXAMINATION CERTFICATE relates only to the design and construction of the specified equipment. If applicable, further requirements of this Directive apply to the manufacture and supply of the equipment.

(12) The marking of the equipment shall include the following:

II 2 G EEx ia IIC T6

Zertifizierungsstelle Explosionsschutz Braunschweig, 01 March 2001
By order

(Signature) (Seal)

Dr. Ing. U. Johannsmeyer
Regierungsdirketor

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(13) **S c h e d u l e**

(14) **EC TYPE EXAMINATION CERTIFICATE No. PTB 99 ATEX 2158**

(15) **Description of Equipment**

The Model 3730-21... i/p Positioner is a single- or double-acting positioner for attachment to linear or rotary actuators. it serves for translating control signals into valve stem positions.

The Model 3730-21... i/p Positioner is a passive two-terminal network which may be connected to any certified intrinsically safe circuit, provided the permissible maximum values of Ui, Ii and Pi are not exceeded.

For pneumatic auxiliary power non-combustible media are used.

The device is intended for use inside and outside of hazardous areas.

The correlation between temperature classification and permissible ambient temperature ranges are shown in the table below:

Temperature class	Permissible ambient temperature range
T6	-40 °C ... 60 °C
T5	-40 °C ... 70 °C
T4	-40 °C ... 80 °C

Version **3730-211...** with inductive limit switch (terminals 41/42)
The correlation between temperature classification, permissible ambient temperature ranges and maximum short-circuit current for analysers is shown in the table below:

Temperature class	Permissible ambient temperature range	Maximum short-circuit current
T6	-40 °C ... 45 °C	
T5	-40 °C ... 60 °C	52mA
T4	-40 °C ... 75 °C	
T6	-40 °C ... 60 °C	
T5	-40 °C ... 80 °C	25mA
T4	-40 °C ... 80 °C	

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Electrical data

Signal circuit (terminals 11/12)

Type of protection. Intrinsic safety EEx ia IIC only for connection to a certified intrinsically safe circuit

Maximum values:

U_i = 28 V
I_i = 115 mA
P_i = 1 W

C_i = 5.3 nF, L_i = negligible

Version **3730-21..1.** Position indicator (terminals 31/32)

Type of protection: Intrinsic safety EEx ia IIC only for connection to a certified intrinsically safe circuit

Maximum values:

U_i = 28 V
I_i = 115 mA
P_i = 1 W

C_i = 5.3 nF, L_i = negligible

Version 3730-211... software limit switches (terminals 41/42, 51/52)

Type of protection: Intrinsic safety EEx ia IIC only for connection to a certified intrinsically safe circuit

Maximum values:

U_i = 28 V
I_i = 115 mA
P_i = 1 W

C_i = 5.3 nF, L_i = negligible

Inductive limit switch (terminals 41/42)

Type of protection: Intrinsic safety EEx ia IIC only for connection to a certified intrinsically safe circuit

Maximum values:

U = 16 V
I_i = 52 mA
P_i = 169 mW

C_i = 60 nF, L_i = 200 μH, or

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U_i = 16 V
I_i = 25 mA
P_i = 64 mW

C_i = 60 nF, L_i = 200 µH

Forced venting function (terminals 81/82)

Type of protection: Intrinsic safety EEx ia IIC only for connection to a certified intrinsically safe circuit

Maximum values:

U = 28 V
I_i = 115 mA
P_i = 0.5 W

C_i = 5.3 nF, L_i = negligible

Alarm output (terminals 83/84)

Type of protection: Intrinsic safety EEx ia IIC only for connection to a certified intrinsically safe circuit

Maximum values:

U = 20 V
I_i = 60 mA
P_i = 250 mW

C_i = 5.3 nF, L_i = negligible

Programming jack BU

Type of protection. Intrinsic safety EEx ia IIC

Maximum values:

U_o = 6.51 V
I_o = 57.5 mA
P_o = 94 mW, Linear characteristic

C_o = 22 µF, L_o = 10 mH

only for connection to a certified intrinsically safe circuit

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Braunschweig und Berlin

PTB

Maximum values:

U_i = 20 V
I_i = 60 mA
P_i = 250 mW

C_i = negligible, L_i = negligible

The rules for interconnecting intrinsically safe circuits shall be complied with.

External position sensor (analog pcb, pins, p9, p10, p11)

Type of protection. Intrinsic safety EEx ia IIC

Maximum values:

U_o = 6.51 V
I = 56 mA
P_o = 91 mW, Linear characteristic

C_o = 11.2 µF, L_o = 11.6 mH
C_i = 730 nF, L_i = 370µH

(16) Test Report: **PTB Ex 01-20216**

(17) **Special conditions for safe use**

Not applicable

(18) **Special Health and Safety Requirements**

In compliance with the standards specified above

Zertifizierungsstelle Explosionsschutz
By order

Braunschweig, 1 March 2001

(Signature) (seal)

Dr. Ing. U. Johannsmeyer
Regierungsdirektor

EC Type Examination Certificates without signature and seal are invalid.
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Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

PTB

TRANSLATION

ADDENDUM No. 1

**in compliance with Directive 94/9/EC Annex III Clause 6
to the EC Type Examination Certificate PTB 00 ATEX 2158**

Equipment: e/p Positioner Model 3730-21..

Marking: Ex **II 2 G EEx ia IIC T6**

Manufacturer: **SAMSON AG**

Address: **Weismüllerstr. 3, D-60314 Frankfurt, Germany**

Description of the additions and modifications

The e/p Positioner Model 3730-21... is permitted to be manufactured in compliance with the documents listed below.

The Modifications related to the internal and external structure. The chokes DR1 and DR2 in the position indicator circuit are replaced by the transformer T8 for EMC reasons.

The electrical data and all other data apply unchanged also to this Addendum No. 1

Test report: **PTB Ex 02-22028**

Zertifizierungsstelle Explosionsschutz Braunschweig, 01. March 2002
By order

(Signature) (Seal)

Dr. Ing. U. Johannsmeyer
Regierungsdirketor

EC Type Examination Certificates without signature and seal are invalid.
This EC Type Examination Certificate may only be reproduced in its entirety and without any changes, schedule included.
Extracts or changes shall require the prior approval of the Physikalisch-Technische Bundesanstalt.

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Braunschweig und Berlin

PTB

ADDENDUM No. 2

**in compliance with Directive 94/9/EC Annex III Clause 6
to the EC Type Examination Certificate PTB 00 ATEX 2158**

Equipment: Model 3730-21..e/p Positioner

Marking: Ex **II 2G EEx ia IIC T6**

Manufacturer: **SAMSON AG**

Address: **Weismüllerstr. 3, D-60314 Frankfurt, Germany**

Description of the additions and modifications

The Model 3730-21... e/p Positioner is permitted to be manufactured also in compliance with the test documents specified in the attached test report PTB Ex 04-23429.

Attachment to pneumatic control valves or butterfly valves is either directly to the Series 3277 Actuators or by means of NAMUR adapter plate to actuators of conventional design.

The modifications relate to the internal and external design.

a) The circuitry of the supply pbc and the multifunction pcb replace the previous analog pcb, and the position indicator module has been modified.

b) The Model 3730-21.. e/p Positioner satisfies the requirements of EN 50281-1-1:1998 relating to electrical apparatus with protection provided by the enclosure. According to this standard, the positioner shall be provided in addition with the following marking:

Ex **II 2D IP65 T80 °C**

EC Type Examination Certificates without signature and seal are invalid.
This EC Type Examination Certificate may only be reproduced in its entirety and without any changes, schedule included.
Extracts or changes shall require the prior approval of the Physikalisch-Technische Bundesanstalt.

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The electrical data and all the other information contained in the EC Type Examination Certificate apply unchanged also to this Addendum No. 2.

Test report: **PTB Ex 04-23429**

Zertifizierungsstelle Explosionsschutz Braunschweig, 16 February 2004
By order

(Signature) (Seal)

Dr. Ing. U. Gerlach

EC Type Examination Certificates without signature and seal are invalid.
This EC Type Examination Certificate may only be reproduced in its entirety and without any changes, schedule included.
Extracts or changes shall require the prior approval of the Physikalisch-Technische Bundesanstalt.

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Braunschweig und Berlin

TRANSLATION

ADDENDUM No.: 3

in compliance with Directive 94/9/EC Annex III Clause 6
to the EC Type Examination Certificate PTB 00 ATEX 2158

Equipment: Model 3730-21 i/p Positioner

Marking: **II 2 G EEx ia IIC T 6 and**
II 2 D IP 65 T 80 °C

Manufacturer: SAMSON AG Mess- und Regeltechnik

Address: Weismüllerstrasse 3
D-60314 Frankfurt am Main, Germany

Description of the additions and modifications

The Model 3730-21 ..i/p Positioners are permitted to be manufactured in the future also in compliance with the test documents specified in the Test Report.

The electrical data of the forced ventilation are modified as follows:

Forced ventilation
only for connection(terminals 81/82)

Type of protection: Intrinsic Safety EEx ia IIC
to a certified intrinsically safe circuit

Maximum values:

Ui	=	28 V
Ii	=	115 mA
Li		negligible
Ci	=	5,3 nF

All the other electrical data and other data specified in the EC Type Examination Certificate apply also to this Addendum No. 3.

Test report: **PTB Ex 07-27258**

Zertifizierungsstelle Explosionsschutz

By order Braunschweig, 24. August 2007

(Signature) (Seal)
Dr.-Ing. U. Johannsmeyer
Director and Professor

EC Type examination Certificates without signature and seal are invalid.
This EC Type Examination Certificate may only be reproduced in its entirety and without any change, schedule included. Extracts or changes shall require the prior approval of the Physikalisch-Technische Bundesanstalt.

Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

TRANSLATION

ADDENDUM NO. 4

according to Directive 94/9/EC Annex III Clause 6

to the EC Type Examination Certificate PTB 00 ATEX 2158

Equipment:	e/p-Positioner Type 3730-21..
Marking:	Ⓔx **II 2 G Ex ia IIC T6** and
	Ⓔx **II 2 D Ex tD A21 IP65 T80°C**
Manufacturer:	SAMSON AG Mess- und Regeltechnik
Address:	Weismüllerstr. 3, 60314 Frankfurt am Main, Deutschland

Description of the additions and modifications

The Model 3730-21.. e/p-Positioner is permitted to be manufactured in the future also in compliance with the specified exam documents.

The modifications relate to the internal and external design. The Model range is extended by the Types 3730-21….1. (Vibration sensor) and 3730-21…..2 (Binary input).

Thermal data and all other data of the EC Type Examination Certificate apply unchanged to this Addendum.

The electrical data are supplemented and summarized.

Electrical data

Signal circuit ..... With type of protection Intrinsic Safety Ex ia IIC
(Terminals 11/12) only for connection to a certified intrinsically safe circuit

Maximum values:

Ui = 28 V
Ii = 115 mA
Pi = 1 W

Ci = 5,3 nF
Li negligible

EC Type Examination Certificates without signature and seal are invalid.
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Version **3730-21..1.**
Position indicator ..... With type of protection Intrinsic Safety Ex ia IIC
(Terminals 31/32) only for connection to a certified intrinsically safe circuit

Maximum values:

Ui = 28 V
Ii = 115 mA
Pi = 1 W

Ci = 5,3 nF
Li negligible

or

Version **3730-21….1.**
Vibration sensor ..... With type of protection Intrinsic Safety Ex ia IIC
(Terminals 31/32) only for connection to a certified intrinsically safe circuit

Maximum values:

Ui = 28 V
Ii = 115 mA

Ci = 5,3 nF
Li negligible

or

Version **3730-21…..2**
Binary input ..... With type of protection Intrinsic Safety Ex ia IIC
(Terminals 31/32) only for connection to a certified intrinsically safe circuit

Maximum values:

Ui = 28 V
Ii = 115 mA

Ci = 56,3 nF
Li negligible

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Version **3730-211...**

Software limit switches ..... With type of protection Intrinsic Safety Ex ia IIC
(Terminals 41/42, 51/52) only for connection to a certified intrinsically safe circuit

Maximum values:

Ui = 20 V
Ii = 60 mA
Pi = 250 mW

Ci = 5,3 nF
Li negligible

or

Inductive limit switch..... With type of protection Intrinsic Safety Ex ia IIC
(Terminals 41/42) only for connection to a certified intrinsically safe circuit

Maximum values:

Ui = 16 V
Ii = 52 mA
Pi = 169 mW

Ci = 60 nF
Li = 200 µH

or

Ui = 16 V
Ii = 25 mA
Pi = 64 mW

Ci = 60 nF
Li = 200 µH

Forced venting function ..... With type of protection Intrinsic Safety Ex ia IIC
(Terminals 81/82) only for connection to a certified intrinsically safe circuit

Maximum values:

Ui = 28 V
Ii = 115 mA

Ci = 5,3 nF
Li negligible

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Braunschweig und Berlin
Addendum No. 4 to the EC Type Examination Certificate PTB 00 ATEX 2158

Alarm output..... With type of protection Intrinsic Safety Ex ia IIC
(Terminals 83/84) only for connection to a certified intrinsically safe circuit

Maximum values:

Ui = 20 V
Ii = 60 mA
Pi = 250 mW

Ci = 5,3 nF
Li negligible

Programming jack BU..... With type of protection Intrinsic Safety Ex ia IIC

Maximum values:

Uo= 6,51 V
Io = 57,5 mA
Po= 94 mW
Linear characteristic

Co= 22 µF
Lo = 10 mH

or

only for connection to a certified intrinsically safe circuit

Maximum values:

Ui = 20 V
Ii = 60 mA
Pi = 250 mW

Ci negligible
Li negligible

The rules for the interconnection of intrinsically safe circuit shall be observed.

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Braunschweig und Berlin
Addendum No. 4 to the EC Type Examination Certificate PTB 00 ATEX 2158

External position sensor ..... With type of protection Intrinsic Safety Ex ia IIC
(Analo pcb pins p9, p10, p11)

Maximum values:

Uo= 6,51 V
Io = 56 mA
Po= 91 mW
Linear characteristic

Co= 11,2 µF
Lo = 11,6 mH

Ci = 730 nF
Li = 370 µH

Applied standards

EN 60079-0:2006
EN 60079-11:2007
EN 61241-0:2006
EN 61241-1:2004

Test report: PTB Ex 08-28189

Zertifizierungssektor Explosionsschutz
By order

Braunschweig, November 6, 2008

(Signature) (Seal)

Dr.-Ing. U. Gerlach
Oberregierungsrat

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5. SUPPLEMENT

according to Directive 94/9/EC Annex III.6

to EC-TYPE-EXAMINATION CERTIFICATE PTB 00 ATEX 2158

(Translation)

Equipment: e/p-positioner, type 3730-21..

Marking: Ⓔx **II 2 G Ex ia IIC T6 or II 2 D Ex tD A21 IP65 T80 °C**

Manufacturer: SAMSON AG Mess- und Regeltechnik

Address: Weismüllerstr. 3, 60314 Frankfurt, Germany

Description of supplements and modifications

In the future the e/p-positioner of type 3730-21..may also be manufactured according to the test documents listed in the test report.

The state of the standards has been updated. Further modifications have not been made.

The thermal and electrical maximum values are presented in summary.

For relationship between temperature class and permissible ranges of the ambient temperature, reference is made to the following table:

Temperature class	Permissible range of the ambient temperature
T6	-40 °C ... 60 °C
T5	-40 °C ... 70 °C
T4	-40 °C ... 80 °C

EC-type-examination Certificates without signature and official stamp shall not be valid. The certificates may be circulated only without alteration. Extracts or alterations are subject to approval by the Physikalisch-Technische Bundesanstalt.
In case of dispute, the German text shall prevail.

Type 3730-211... with inductive limit contact (terminals 41/42)

For relationship between temperature class, permissible ranges of the ambient temperature, and the maximum short-circuit currents for analyzing units, reference is made to the following table:

Temperature class	Permissible range of the ambient temperature	Maximum short-circuit current
T6	-45 °C ... 45 °C	52 mA
T5	-45 °C ... 60 °C	
T4	-45 °C ... 75 °C	
T6	-40 °C ... 60 °C	25 mA
T5	-40 °C ... 80 °C	
T4	-40 °C ... 80 °C	

Electrical data

Signal circuit (terminals 11/12) ..... type of protection Intrinsic Safety Ex ia IIC
only for connection to a certified intrinsically safe circuit

Maximum values:

U_i = 28 V
I_i = 115 mA
P_i = 1 W

C_i = 5.3 nF
L_i negligibly low

Type 3730-21..1.

Position indicator (terminals 31/32) ..... type of protection Intrinsic Safety Ex ia IIC
only for connection to a certified intrinsically safe circuit

Maximum values:

U_i = 28 V
I_i = 115 mA
P_i = 1 W

C_i = 5.3 nF
L_i negligibly low

or

EC-type-examination Certificates without signature and official stamp shall not be valid. The certificates may be circulated only without alteration. Extracts or alterations are subject to approval by the Physikalisch-Technische Bundesanstalt.
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Physikalisch-Technische Bundesanstalt

Braunschweig und Berlin

5. SUPPLEMENT TO EC-TYPE-EXAMINATION CERTIFICATE PTB 00 ATEX 2158

Type 3730-21....1.

Structure-borne sound sensor.....type of protection Intrinsic Safety Ex ia IIC
(terminals 31/32) only for connection to a certified intrinsically safe circuit

Maximum values:

U_i = 28 V
I_i = 115 mA

C_i = 5.3 nF
L_i negligibly low

or

Type 3730-21.....2

Binary input.....type of protection Intrinsic Safety Ex ia IIC
(terminals 31/32) only for connection to a certified intrinsically safe circuit

Maximum values:

U_i = 28 V
I_i = 115 mA

C_i = 56.3 nF
L_i negligibly low

Type 3730-211...

Software-limit contacts.....type of protection Intrinsic Safety Ex ia IIC
(terminals 41/42, 51/52) only for connection to a certified intrinsically safe circuit

Maximum values:

U_i = 20 V
I_i = 60 mA
P_i = 250 mW

C_i = 5.3 nF
L_i negligibly low

or

Limit contact inductive .....type of protection Intrinsic Safety Ex ia IIC
(terminals 41/42) only for connection to a certified intrinsically safe circuit

Maximum values:

U_i = 16 V
I_i = 52 mA
P_i = 169 mW
C_i = 30 nF
L_i = 100 µH

or

EC-type-examination Certificates without signature and official stamp shall not be valid. The certificates may be circulated only without alteration. Extracts or alterations are subject to approval by the Physikalisch-Technische Bundesanstalt.
In case of dispute, the German text shall prevail.

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5. SUPPLEMENT TO EC-TYPE-EXAMINATION CERTIFICATE PTB 00 ATEX 2158

U_i = 16 V
I_i = 25 mA
P_i = 64 mW

C_i = 30 nF
L_i = 100 µH

Forced venting.....type of protection Intrinsic Safety Ex ia IIC
(terminals 81/82) only for connection to a certified intrinsically safe circuit

Maximum values:

U_i = 28 V
I_i = 115 mA

C_i = 5.3 nF
L_i negligibly low

Fault signal output .....type of protection Intrinsic Safety Ex ia IIC
(terminals 83/84) only for connection to a certified intrinsically safe circuit

Maximum values:

U_i = 20 V
I_i = 60 mA
P_i = 250 mW

C_i = 5.3 nF
L_i negligibly low

Programming socket BU.....type of protection Intrinsic Safety Ex ia IIC

Maximum values:

U_o = 6.51 V
I_o = 57.5 mA
P_o = 94 mW
linear characteristic

C_o = 22 µF
L_o = 10 mH

or

EC-type-examination Certificates without signature and official stamp shall not be valid. The certificates may be circulated only without alteration. Extracts or alterations are subject to approval by the Physikalisch-Technische Bundesanstalt.
In case of dispute, the German text shall prevail.

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5. SUPPLEMENT TO EC-TYPE-EXAMINATION CERTIFICATE PTB 00 ATEX 2158

only for connection to a certified intrinsically safe circuit

Maximum values:

U_i = 20 V
I_i = 60 mA
P_i = 250 mW

C_i negligibly low
L_i negligibly low

The rules for the interconnection of intrinsically safe circuits shall be observed.

External position sensor .....type of protection Intrinsic Safety Ex ia IIC
(Analog PCB, pins p9, p10, p11)

Maximum values:

U_o = 6.51 V
I_o = 56 mA
P_o = 91 mW
linear characteristic

C_o = 11.2 µF
L_o = 11.6 mH

C_i = 730 nF
L_i = 370 µH

The future marking reads:

⟨Ex⟩ **II 2 G Ex ia IIC T6 Gb and II 2 D Ex tb IIIC T80 °C Db IP66**

Applied standards

EN 60079-0:2009 **EN 60079-11:2012** **EN 60079-31:2009**

Test report: PTB Ex 13-23132

Zertifizierungssektor Explosionsschutz
On behalf of PTB:

Dr.-Ing. U. Johannsmeyer
Direktor und Professor

Braunschweig, August 19, 2013

EC-type-examination Certificates without signature and official stamp shall not be valid. The certificates may be circulated only without alteration. Extracts or alterations are subject to approval by the Physikalisch-Technische Bundesanstalt.
In case of dispute, the German text shall prevail.

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Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

PTB

TRANSLATION

(1) **Statement of Conformity**

(2) Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres – **Directive 94/9/EC**

(3) EC Type Examination Certificate Number

PTB 03 ATEX 2016 X

(4) Equipment: Model 3730-28... e/p Positioner

(5) Manufacturer: SAMSON AG

(6) Address: Weismüllerstr. 3, D-60314 Frankfurt, Germany

(7) This equipment and any acceptable variation thereof are specified in the schedule to this certificate.

(8) The Physikalisch-Technische Bundesanstalt, notified body number 0102 according to Article 9 of the Council Directive 94/9/EC of 23 March 1994, certifies that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres as specified in Annex II to the Directive.

The examination and test results are recorded in confidential report PTB Ex 03-22404.

(9) The Essential Health and Safety Requirements are satisfied by compliance with

EN 50021: 1999

(10) If the sign "X" is placed after the certificate number, it indicates that the equipment is subject to special conditions for safe use specified in the schedule to this certificate.

EC Type Examination Certificates without signature and seal are invalid.
This EC Type Examination Certificate may only be reproduced in its entirety and without any changes, schedule included.
Extracts or changes shall require the prior approval of the Physikalisch-Technische Bundesanstalt.

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Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

PTB

Test Report: **PTB Ex 03-22404**

(11) In compliance with the Directive 94/9/EC this Statement of Conformity relates only to the design and construction of the equipment specified. If applicable. Further requirements of this Directive apply to the manufacture and marketing of the equipment.

(12) The marking of the equipment shall include the following:

II 3 G EEx nA IIC T6

Zertifizierungsstelle Explosionsschutz
By order

Braunschweig, 07 March 2003

(Signature) (Seal)

Dr. Ing. U. Johannsmeyer
Regierungsdirketor

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Ptb18Ex n.doc

(13) **S c h e d u l e**

(14) **Statement of Conformity PTB 03 ATEX 2016 X**

(15) **Description of Equipment**

The Model 3730-28... e/p Positioner is a single- or double-acting positioner for attachment to linear or rotary actuators.. It serves for adjusting valve stem positions to the control signal.

For supply air non-combustible media are used.

The device is intended for use inside and outside of hazardous locations.

The correlation between temperature classification and permissible ambient temperature ranges is shown in the table below:

Temperature class	Permissible ambient temperature range
T6	-40 °C ... 60 °C
T5	-40 °C ... 70 °C
T4	-40 °C ... 80 °C

The same data apply to the version with metallic cable entry.

Electrical data

Signal circuit (terminals 11/12)	Type of protection EEx nA II
Position indicator (terminals 31/32)	Type of protection EEx nA II
Inductive limit switch (terminals 41/42)	Type of protection EEx nA II
Software limit switch (terminals 41/42, 51/52)	Type of protection EEx nA II
Forced ventilation function (terminals 81/82)	Type of protection EEx nA II
Fault alarm output (terminals 83/84)	Type of protection EEx nA II
Programme Interface Adapter	Type of protection EEx nA II

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Braunschweig und Berlin

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(16) Test Report: **PTB Ex 03-22404**

(17) Special conditions for safe use

The Model 3730-28... e/p Positioner shall be installed in an enclosure providing at least Degree of Protection IP 54 in compliance with the IEC Publication 60529:1989. This requirement applies also to cable entrics and/or plug connectors.

The wiring shall be connected in such a manner that the connection facilities are not subjected to pull and/or twisting.

The signal circuit (terminals 11/12) shall be provided with a series connected fuse outside of the hazardous locations. This fuse shall comply with IEC 127-2/II, 250 V F, or with IEC 127-2/VI, 250 T, with a fuse nominal current of $I_N \leq 63$ mA.

The position indicator circuit shall be provided with a series connected fuse outside of the hazardous location. This fuse shall comply with IEC 127-2/II, 250 V F, or with IEC 127-2/VI, 250 V T, with fuse nominal current I_N of ≤ 40 mA.

(18) Special Health and Safety Requirements

Are satisfied by compliance with the standards specified above.

Zertifizierungsstelle Explosionsschutz
By order

Braunschweig, 7 March 2003

(Signature) (seal)

Dr. Ing. U. Johannsmeyer
Regierungsdirektor

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TRANSLATION

ADDENDUM No.: 1

to the Statement of conformity PTB 03 ATEX 2016 X

Equipment:	Model 3730-28.. e/p Positioner
Marking:	Ex II 3G EEx nA II T6
Manufacturer:	SAMSON AG, Mess- und Regeltechnik
Address:	Weismüllerstr. 3, D-60314 Frankfurt, Germany

Description of the additions and modifications

The Model 3730-28..e/p Positioner may be connected in future also to energy-limited circuits with type of protection EEx nL IIC T6. The electrical data are complemented as follows:

The correlation between temperature classification and permissible temperature ranges is shown in the table below.

Temperature class	Permissible ambient temperature range
T6	-40°C . . .60°C
T5	-40°C . . .70°C
T4	-40°C . . .80°C

The electrical data will be supplemented as follows:

Electrical data

Signal circuit
(terminals 11/12)

Type of protection EEx nA II
or EEx nL IIC

Maximum values
U_i = 30 V
I_i = 100 mA
P_i = 1 W

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C_i = 5.3 nF
L_i = negligible

Position indicator
(terminals 31/32)

Type of protection EEx nA II
or EEx nL IIC

Maximum values
U_i = 30 V
I_i = 100 mA
P_i = 1 W

C_i = 5.3 nF
L_i = negligible

Limit switch (inductive)
(terminals 41/42)

Type of protection EEx nA II
or EEx nL IIC

Maximum values
U_i = 20 V
I_i = 52 mA
P_i = 169 mW

C_i = 60 nF
L_i = 200 µH
or
Maximum value
U_i = 20 V
I_i = 25 mA
P_i = 64 mW

C_i = 60 nF
L_i = 200 µH

The correlation between temperature classification, permissible ambient temperature ranges, maximum short-circuit current and the maximum power for analysers is shown in the table below:

Temperature class	Permissible ambient temperature range	Io / Po
T6 **T5** **T4**	45 °C -45 °C ... 60 °C 75 °C	52mA/169mW
T6 **T5** **T4**	60 °C -40 °C ... 80 °C 80 °C	25mA/64mW

Limit switch (software) (terminals 41/42; 51/52)	Type of protection EEx nA II or EEx nL IIC Maximum values U_i = 20 V I_i = 60 mA P_i = 400 mW C_i = 5,3 nF L_i = negligible
Forced venting function (terminals 81/82)	Type of protection EEx nA II or EEx nL IIC Maximum values U_i = 30 V I_i = 100 mA C_i = 5,3 nF L_i = negligible
Fault alarm output (terminals 83/84)	Type of protection EEx nA II or EEx nL IIC Maximum values U_i = 20 V I_i = 60 mA P_i = 400 mW C_i = 5,3 nF L_i = negligible
Program interface adapter	Type of protection EEx nA II or EEx nL IIC Maximum values (active) U_o = 6,51 V I_o = 57,5 mA P_o = 94 mW Linear characteristic C_o = 22 μF L_o = 10 mH Maximum values (passive) U_i = 20 V I_i = 60 mA P_i = 400 mW C_i = negligible L_i = negligible

For interconnections the requirements for interconnecting intrinsically safe circuits shall be complied with.

The equipment is mounted in a metallic enclosure providing at least degree of protection IP 54.

The marking of the Model 3730-28 e/p positioner is complemented as follows:

II 3 G EEx nA II T6 or II 3 G EEx nL IIC T6
II 3 D IP 54 T 80 °C or II 3 D IP 65 T 80 °C

The special conditions and all the other data apply unaltered also to this Addendum No. 1

Test report: PTB Ex-05-25094

Zertifizierungsstelle Explosionsschutz Braunschweig, 03 May 2005
By order

(Signature) (Seal)

Dr. Ing. U. Johannsmeyer
Regierungsdirektor

Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

TRANSLATION

ADDENDUM NO. 2

to the Statement of Conformity PTB 03 ATEX 2016 X

Equipment:	e/p-Positioner Type 3730-28..
Marking:	**II 3 G Ex nA II T6** or **II 3 G Ex nL IIC T6** and **II 3 D Ex tD A21 IP65 T80°C**
Manufacturer:	SAMSON AG Mess- und Regeltechnik
Address:	Weismüllerstr. 3, 60314 Frankfurt am Main, Deutschland

Description of the additions and modifications

The Model 3730-28.. e/p-Positioner is permitted to be manufactured in the future also in compliance with the specified exam documents.

The modifications relate to the internal and external design. The Model range is extended by the Types 3730-28....1. (Vibration sensor) and 3730-28.....2 (Binary input).

Thermal data and all other data of the EC Type Examination Certificate apply unchanged to this Addendum.

The electrical data are supplemented and summarized.

Electrical data

Signal circuit (Terminals 11/12) — With type of protection or — Ex nA II / Ex nL IIC

Maximum values:

Ui = 30 V
Ii = 100 mA
Pi = 1 W

Ci = 5,3 nF
Li negligible

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Braunschweig und Berlin
Addendum No. 2 to the Statement of Conformity PTB 03 ATEX 2016 X

Version **3730-28..1.**
Position indicator (Terminals 31/32) — With type of protection or — Ex nA II / Ex nL IIC

Maximum values:

Ui = 28 V
Ii = 115 mA
Pi = 1 W

Ci = 5,3 nF
Li negligible

or

Version **3730-28....1.**
Vibration sensor (Terminals 31/32) — With type of protection or — Ex nA II / Ex nL IIC

Maximum values:

Ui = 28 V
Ii = 115 mA

Ci = 5,3 nF
Li negligible

or

Version **3730-28.....2**
Binary input (Terminals 31/32) — With type of protection or — Ex nA II / Ex nL IIC

Maximum values:

Ui = 28 V
Ii = 115 mA

Ci = 56,3 nF
Li negligible

Version **3730-281...**
Software limit switches (Terminals 41/42, 51/52) — With type of protection or — Ex nA II / Ex nL IIC

Maximum values:

Ui = 20 V
Ii = 60 mA
Pi = 400 mW

Ci = 5,3 nF
Li negligible

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or

Inductive limit switch..... With type of protection Ex nA II
(Terminals 41/42) or Ex nL IIC

Maximum values:

Ui = 16 V
Ii = 52 mA
Pi = 169 mW

Ci = 60 nF
Li = 200 µH

or

Ui = 16 V
Ii = 25 mA
Pi = 64 mW

Ci = 60 nF
Li = 200 µH

Forced venting function ..... With type of protection Ex nA II
(Terminals 81/82) or Ex nL IIC

Maximum values:

Ui = 30 V
Ii = 100 mA

Ci = 5,3 nF
Li negligible

Alarm output..... With type of protection Ex nA II
(Terminals 83/84) or Ex nL IIC

Maximum values:

Ui = 20 V
Ii = 60 mA
Pi = 400 mW

Ci = 5,3 nF
Li negligible

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Addendum No. 2 to the Statement of Conformity PTB 03 ATEX 2016 X

Programming jack BU..... With type of protection Ex nA II
or Ex nL IIC

Maximum values (active):

Uo= 6,51 V
Io = 57,5 mA
Po= 94 mW
Linear characteristic

Co= 22 µF
Lo = 10 mH

or

Maximum values (passive):

Ui = 20 V
Ii = 60 mA
Pi = 400 mW

Ci negligible
Li negligible

The rules for the interconnection of intrinsically safe circuit shall be observed.

Applied standards

EN 60079-15:2005 **EN 61241-0:2006** **EN 61241-1:2004**

Test report: PTB Ex 08-28191

Zertifizierungssektor Explosionsschutz Braunschweig, November 6, 2008
By order

(Signature) (Seal)

Dr.-Ing. U. Gerlach
Oberregierungsrat

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Braunschweig und Berlin

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3. SUPPLEMENT

to CONFORMITY STATEMENT PTB 03 ATEX 2016 X

(Translation)

Equipment: e/p-positioner, type 3730-28..

Marking: Ⓔx **II 3 G Ex nA II T6 or II 3 G Ex nL IIC T6 and II 3 D Ex tD A21 IP65 T80 °C**

Manufacturer: SAMSON AG Mess- und Regeltechnik

Address: Weismüllerstr. 3, 60314 Frankfurt, Germany

Description of supplements and modifications

In the future the e/p-positioner of type 3730-28.. may also be manufactured according to the test documents listed in the test report.

The state of the standards has been updated. Further modifications have not been made.

The thermal and electrical maximum values are presented in summary.

For relationship between temperature class and permissible ranges of the ambient temperature, reference is made to the following table:

Temperature class	Permissible range of the ambient temperature
T6	-40 °C ... 60 °C
T5	-40 °C ... 70 °C
T4	-40 °C ... 80 °C

Electrical data

Signal circuit ..... type of protection Ex ic IIC
(terminals 11/12) or Ex nA II

Operational maximum values

U_i = 30 V
I_i = 100 mA
P_i = 1 W

C_i = 5.3 nF
L_i negligibly low

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Braunschweig und Berlin

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Type 3730-28..1.

Position indicator ..... type of protection Ex ic IIC
(terminals 31/32) or Ex nA II

Operational maximum values

U_i = 28 V
I_i = 115 mA
P_i = 1 W

C_i = 5.3 nF
L_i negligibly low

or

Type 3730-28....1 ..... type of protection Ex ic IIC
(Structure-borne sound sensor) or Ex nA II
(terminals 31/32)

Operational maximum values

U_i = 28 V
I_i = 115 mA

C_i = 5.3 nF
L_i negligibly low

Type 3730-28.....2 ..... type of protection Ex ic IIC
Binary input or Ex nA II
(terminals 31/32)

Operational maximum values

U_i = 28 V
I_i = 115 mA

C_i = 56.3 nF
L_i negligibly low

Type 3730-281...
Limit contacts, software ..... type of protection Ex ic IIC
(terminals 41/42, 51/52) or Ex nA II

Operational maximum values

U_i = 20 V
I_i = 60 mA
P_i = 400 mW

C_i = 5.3 nF
L_i negligibly low

or

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Limit contact, inductive ..... type of protection Ex ic IIC
(terminals 41/42) or Ex nA II

Operational maximum values

U_i = 20 V
I_i = 52 mA
P_i = 169 mW

L_i = 100 µH
C_i = 30 nF

or

U_i = 20 V
I_i = 25 mA
P_i = 64 mW

L_i = 100 µH
C_i = 30 nF

Forced venting ..... type of protection Ex ic IIC
(terminals 81/82) or Ex nA II

Operational maximum values

U_i = 30 V
I_i = 100 mA

C_i = 5.3 nF
L_i negligibly low

Fault signal output ..... type of protection Ex ic IIC
(terminals 83/84) or Ex nA II

Operational maximum values

U_i = 20 V
I_i = 60 mA
P_i = 400 mW

C_i = 5.3 nF
L_i negligibly low

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Physikalisch-Technische Bundesanstalt

Braunschweig und Berlin

3. SUPPLEMENT TO CONFORMITY STATEMENT PTB 03 ATEX 2016 X

Programming plug ..... type of protection Ex ic IIC
or Ex nA II

Operational maximum values (active)

U_o = 6.51 V
I_o = 57.5 mA
P_o = 94 mW
linear characteristic
C_o = 22 µF
L_o = 10 mH

or

Operational maximum values (passive)

U_i = 20 V
I_i = 60 mA
P_i = 400 mW
L_i negligibly low
C_i negligibly low

The rules for the interconnection of intrinsically safe circuits shall be observed.

The special conditions are supplemented:

Special Conditions

Type of protection Ex ic IIC

If the signal circuit is connected to a circuit of type of protection Ex ic IIC a fuse shall be connected in series.
The equipment may be switched operationally.

Type of protection Ex nA II

A fuse according to IEC 127-2/II, 250 V F or IEC 127-2/VI, 250 V T with a maximum nominal fuse current of $I_N \leq 63$ mA shall be connected in series to the signal circuit (terminals 11/12). This fuse shall be arranged outside of the hazardous area.

A fuse according to IEC 127-2/II, 250 V F or IEC 127-2/VI, 250 V T with a maximum nominal fuse current of $I_N \leq 40$ mA shall be connected in series to the position indicator circuit (terminals 31/32). This fuse shall be arranged outside of the hazardous area.

A fuse according to IEC 127-2/II, 250 V F or IEC 127-2/VI, 250 V T with a maximum nominal fuse current of $I_N \leq 40$ mA shall be connected in series in the Vco-connection of the program interface adaptor. This fuse shall be arranged outside of the hazardous area.

Connection, disconnection and switching of energized circuits is only permitted during installation, maintenance or repair.

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3. SUPPLEMENT TO CONFORMITY STATEMENT PTB 03 ATEX 2016 X

Protection by Enclosure

The manufacturer shall guarantee and document that the enclosure of the equipment including all cable glands meets the degree of protection of either IP54 or IP65 according to IEC 60529 depending on the respective application. The cables shall be connected such that the point of connection is free from tensile and torsional stress.

Notes for manufacture and operation

All other specifications of the conformity statement apply without changes also to this supplement.

The operating instructions manual shall be updated.

The future marking reads:

II 3 G Ex ic IIC T6 Gc or II 3 G Ex nA II T6 Gc and
II 3 D Ex tc IIIC T80°C Dc IP65

Applied standards

EN 60079-0:2009 **EN 60079-15:2010** **EN 60079-31:2009**

Test report: PTB Ex 13-23134

Zertifizierungssektor Explosionsschutz
By order:

Braunschweig, August 16, 2013

Dr.-Ing. U. Johannsmeier
Direktor und Professor

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Installation Manual for apparatus certified by CSA for use in hazardous locations.

Electrical rating of intrinsically safe apparatus and apparatus for installation in hazardous locations.

Table 1: Maximum values

	Control signal	Position Indicator *or* (Binary Input) *or* [Leakage detection]	Forced venting function Solenoid valve	Limit switches		Fault signal
				inductive	software	
Circuit No.	1	2	5	3 and 4	3 and 4	6
Terminal No.	11 / 12	31 / 32	81 / 82	41 / 42 and 51 / 52	41 / 42 and 51 / 52	83 / 84
U_i or V_{max}	28V	28V	28V	16V	20V	20V
I_i or I_{max}	115mA	115mA (100mA) [100mA]	115mA	25/52 mA	60mA	60mA
P_i or P_{max}	1W	1W	500mW	64/169mW	250mW	250mW
C_i	5,3nF	5.3nF (56,3nF) [5,3nF]	5.3nF	60nF	13.4nF	13.4nF
L_i	0µH	0µH	0µH	100µH	0µH	0µH

Circuit	Serial interface BU			External position sensor		
Terminal	Connector			Analog pcb. pin p9, p10, p11		
U_i or V_{max}	20V	U_o or V_{OC}	6,51V	U_o or V_{OC}	6,51V	
I_i or I_{max}	60mA	I_o or I_{SC}	57,5mA	I_o or I_{SC}	56mA	
P_i or P_{max}	250mW	P_o	94mW	P_o	91mW	
C_i	0nF	C_o	22µF	C_o	11,2µF	C_i=730nF
L_i	0µH	L_o	10mH	L_o	11,6mH	L_i=370µH

Notes: Entity parameters must meet the following requirements:

U_o or V_{OC} or $V_t \leq U_i$ or V_{max} / I_o or I_{SC} or $I_t \leq I_i$ or I_{max} / P_o or $P_{max} \leq P_i$ or P_{max}
$C_a \geq C_i + C_{cable}$ and $L_a \geq L_i + L_{cable}$

Table 2: CSA/FM – certified barrier parameters of circuit 2 and 5

Barrier	Supply barrier				Evaluation barrier		
	V_{OC}	R_{min}	I_{SC}	P_{max}	V_{OC}	R_{min}	I_{SC}
circuit 2	≤28V	≥300Ω	≤115mA	≤1W	≤28V	#	0mA
circuit 5	≤28V	≥392Ω	≤115mA	≤500mW	≤28V	#	0mA

Table 3: The correlation between temperature classification and permissible ambient temperature ranges is shown in the table below:

Temperature class	Permissible ambient temperature range
T6	- 40°C ... 60°C
T5	- 40°C ... 70°C
T4	- 40°C ... 80°C

Table 4: For the Model 3730 – 231 . . . Positioner the correlation between temperature classification, permissible ambient temperature ranges and maximum short- circuit current is shown in the table below:

Temperature class	Permissible ambient temperature range	Maximum short-circuit current
T6	- 40°C ... 45°C	52mA
T5	- 40°C ... 60°C	
T4	- 40°C ... 75°C	
T6	- 40°C ... 60°C	25mA
T5	- 40°C ... 80°C	
T4	- 40°C ... 80°C	

Intrinsically safe if installed as specified in manufacturer's installation manual.

CSA- certified for hazardous locations

Ex ia IIC T6: Class I, Zone 0
Class I, Div. 1, Groups A, B, C, D.
Class II Div. 1, Groups E, F + G; Class III. **Type 4 Enclosure**

Notes:

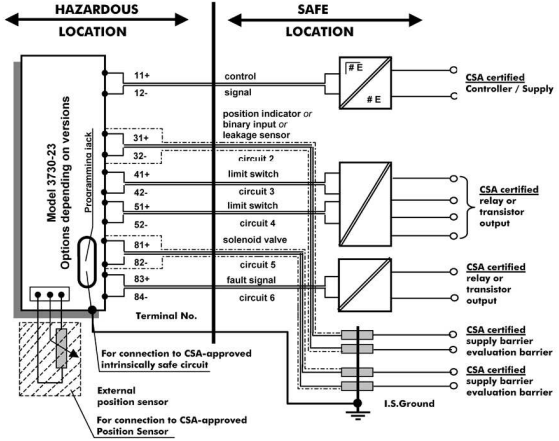
1.) The apparatus may be installed in intrinsically safe circuits only when used in conjunction with CSA certified apparatus. For maximum values of Ui or V_{max}; Ii or I_{max}; Pi or P_{max} ; Ci and Li of the various apparatus see Table 1 on page 1.

2.) For barrier selection see Table 2 on page 2.

3.) The installation must be in accordance with the C. E. C. Part 1.

4.) Use only supply wires suitable for 5°C above surrounding temperature.

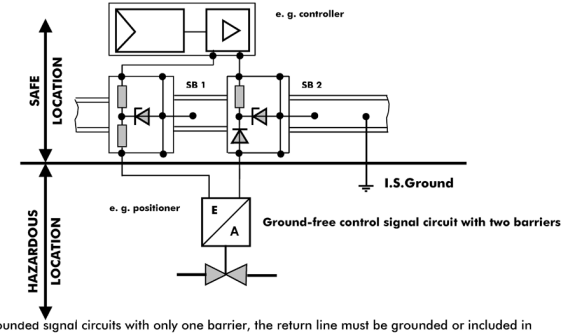
5.) For CSA Certification, Safety Barrier must be CSA Certified and installed in accordance with C.E.C. Part. 1. Each pair of I.S. wires must be protected by a shield that is grounded at the I.S. Ground. The shield must extend as close to the terminals as possible.



For the permissible maximum values for the intrinsically safe circuits 1,3,4 and 6 see Table 1
For the permissible barrier parameters for the circuits 2 and 5 see Table 2
Cable entry M 20 x 1.5 or metal conduit according to drawing No. 1050 – 0539 T
or 1050 – 0540 T

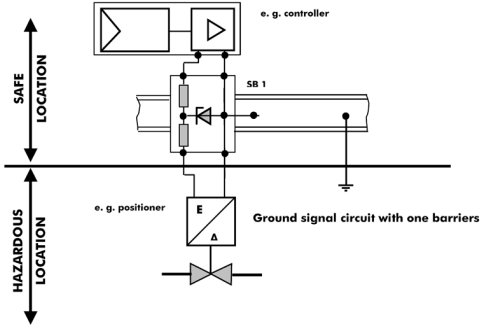
On interconnection to form ground- free signal circuits, only evaluation barriers must be installed in the return line. Correct polarity must be ensured.

Circuit diagram of a ground- free signal circuit.
(position indicator and forced venting function)



In grounded signal circuits with only one barrier, the return line must be grounded or included in the potential equalization network of the system.

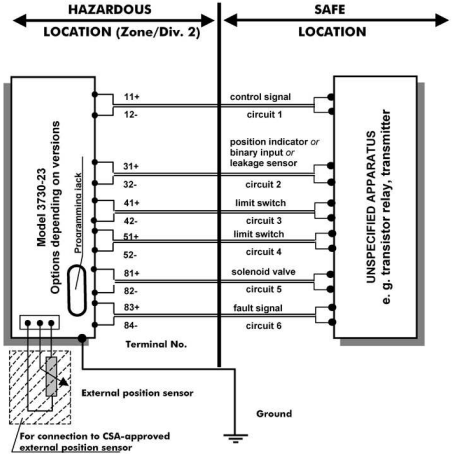
Circuit diagram of a grounded signal circuit
(position indicator and forced venting function)



CSA- certified for hazardous locations

Class I, Zone 2
Class I, Division 2, Groups A, B, C, D,
Class II, Groups E, F + G; Class III. **Type 4 Enclosure**

e/p - positioner with position indicator, forced venting function (solenoid valve), fault signal and limit switches.



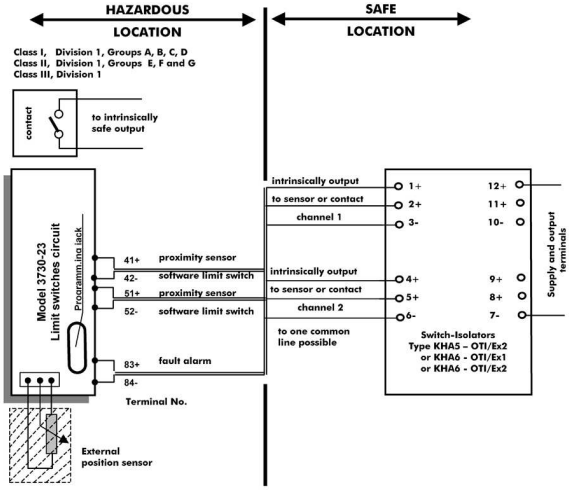
Notes:

1.) The installation must be in accordance with the Canadian Electrical Code, Part 1

2.) For the maximum values for the individual circuits see Table 1 and 2.

3.) Cable entry only rigid metal conduit according to drawing No. 1050-0539 T and 1050-0540 T

Installation drawing Control Relay KHA5-OTI/Ex2, KHA6-OTI/Ex1 or KHA6-OTI/Ex2 with Model SJ-b-N Proximity Sensors



maximum capacitance of each inductive sensor 60nF
maximum inductance of each inductive sensor 200µH

The total series inductance and shunt capacitance of shield wiring shall be restricted to the following maximum values

Control Relay Terminal No.	Groups	L [mH]	C [µF]	VOC [V]	ISC [mA]
1-3; 2-3 4-6; 5-6	A + B	84,8	1,27	12,9	19,8
	C	299	3,82		
	D	744	10,2		

Each pair of I.S. wires must be protected by a shield that is grounded at the I.S. Ground. The shield must extend as close to the terminals as possible Install per C.E.C. Part 1.

Installation Manual for apparatus approved by FM for use in hazardous locations.

Electrical rating of intrinsically safe apparatus and apparatus for installation in hazardous locations.

Table 1: Maximum values

	Control signal	Position Indicator or (Binary Input) or [Leakage detection]	Forced venting function Solenoid valve	Limit switches		Fault signal
				inductive	software	
Circuit No.	1	2	5	3 and 4	3 and 4	6
Terminal No.	11 / 12	31 / 32	81 / 82	41 / 42 and 51 / 52	41 / 42 and 51 / 52	83 / 84
U_i or V_{max}	28V	28V	28V	16V	20V	20V
I_i or I_{max}	115mA	115mA (100mA) [100mA]	115mA	25/52 mA	60mA	60mA
P_i or P_{max}	1W	1W	500mW	64/169mW	250mW	250mW
C_i	5,3nF	5.3nF (56,3nF) [5,3nF]	5.3nF	60nF	13.4nF	13.4nF
L_i	0µH	0µH	0µH	100µH	0µH	0µH

Circuit	**Serial interface BU**			**External position sensor**		
Terminal	**Connector**			**Analog pcb. pin p9, p10, p11**		
U_i or V_{max}	20V	**U_o or V_{OC}**	6,51V	**U_o or V_{OC}**	6,51V	
I_i or I_{max}	60mA	**I_o or I_{SC}**	57,5mA	**I_o or I_{SC}**	56mA	
P_i or P_{max}	250mW	**P_o**	94mW	**P_o**	91mW	
C_i	0nF	**C_o**	22µF	**C_o**	11,2µF	Ci=730nF
L_i	0µH	**L_o**	10mH	**L_o**	11,6mH	Li=370µH

Notes: Entity parameters shall meet the following requirements:

U_o or V_{OC} or $V_t \leq U_i$ or V_{max} / I_o or I_{SC} or $I_t \leq I_i$ or I_{max} / P_o or $P_{max} \leq P_i$ or P_{max}
$C_a \geq C_i + C_{cable}$ and $L_a \geq L_i + L_{cable}$

Table 2: FM/ CSA – approved barrier parameters of circuit 2 and 5

Barrier	**Supply barrier**				**Evaluation barrier**		
	V_{OC}	**R_{min}**	**I_{SC}**	**P_{max}**	**V_{OC}**	**R_{min}**	**I_{SC}**
circuit 2	≤28V	≥196Ω	≤115mA	≤1W	≤28V	#	0mA
circuit 5	≤28V	≥392Ω	≤115mA	≤500mW	≤28V	#	0mA

Table 3: The correlation between temperature classification and permissible ambient temperature ranges is shown in the table below:

Temperature class	**Permissible ambient temperature range**
T6	60°C
T5	- 40°C ≤ ta ≤ 70°C
T4	80°C

Table 4: For the Model 3730 – 331 . . . Positioner the correlation between temperature classification, permissible ambient temperature ranges and maximum short- circuit current is shown in the table below:

Temperature class	**Permissible ambient temperature range**	**Maximum short-circuit current**
T6	45°C	52mA
T5	- 40°C ≤ ta ≤ 60°C	
T4	75°C	
T6	60°C	25mA
T5	- 40°C ≤ ta ≤ 80°C	
T4	80°C	

Intrinsically safe if installed as specified in manufacturer's installation manual.
FM- approved for hazardous locations

Class I, Zone 0 A Ex ia IIC T6:
Class I, II, III, Div. 1, Groups A, B, C, D, E, F + G;

NEMA 4X

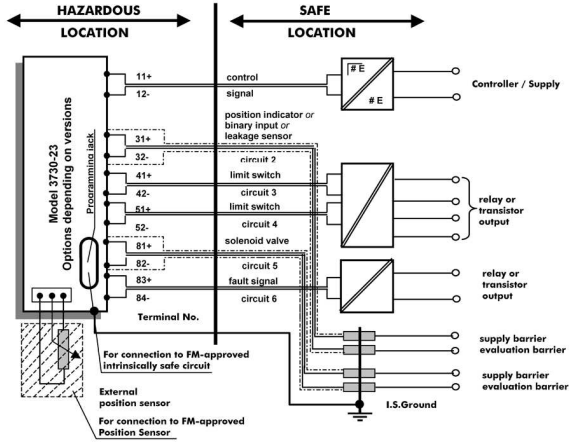
Notes:

1.) The apparatus may be installed in intrinsically safe circuits only when used in conjunction with FM/CSA approved apparatus. For maximum values of U_i or V_{max}; I_i or I_{max}; P_i or P_{max} ; C_i and L_i of the various apparatus see Table 1 on page 7.

2.) For barrier selection see Table 2 on page 8.

3.) The installation shall be in accordance with the National Electrical Code ANSI/NFPA 70 and ANSI/ISA RP 12.06.01.

4.) Use only supply wires suitable for 5°C above surrounding temperature.



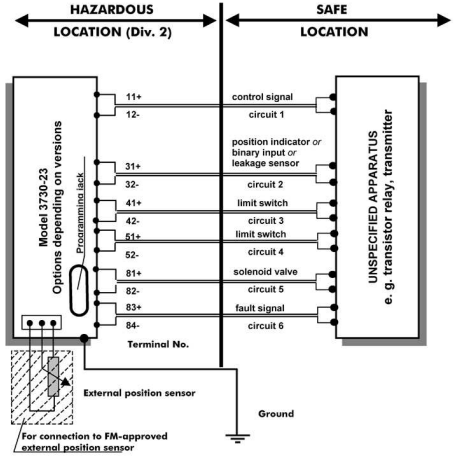
For the permissible maximum values for the intrinsically safe circuits 1,3,4 and 6 see Table 1
For the permissible barrier parameters for the circuits 2 and 5 see Table 2
Cable entry M 20 x 1.5 or metal conduit according to drawing No. 1050 – 0539 T
or 1050 – 0540 T

FM- approved for hazardous locations

Class I, Division 2, Groups A, B, C, D,
Class II, Division 2 Groups F + G.

NEMA 4X

e/p positioner with position indicator or binary input or leakage detection, forced venting function (solenoid valve), fault signal and limit switches.

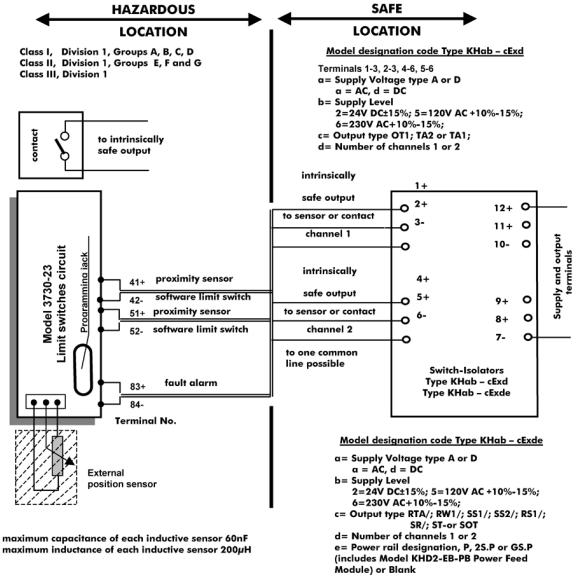


Notes:

1.) The installation shall be in accordance with the National Electrical Code ANSI/NFPA 70

2.) For the maximum values for the individual circuits see Table 1
Cable entry only rigid metal conduit

Installation drawing Control Relay KHab-cEx de Model SJ-b-N Proximity Sensors



The total series inductance and shunt capacitance of shield wiring shall be restricted to the following maximum values

Control Relay Terminal No.	Groups	L [mH]	C [µF]	VOC [V]	ISC [mA]
1-3; 2-3 4-6; 5-6	A + B	84,8	1,27	12,9	19,8
	C	299	3,82		
	D	744	10,2		

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